Welcome to the West Midlands Health Informatics Network (WIN) second Annual Conference. The conference is supported by the West Midlands Academic Health Science Network and hosted by the Institute of Digital Healthcare at the University of Warwick.

WIN has grown considerably over the last year, in terms of membership, scope, stakeholder engagement, and geographic reach. This has been achieved through a combination of social media activity, events, word-of-mouth, and member involvement. Membership has increased by more than 50%, our diverse range of events attracted 240 attendees, and we have mapped main contacts within NHS Trusts across the region. Industry engagement increased considerably throughout 2015, and, as WIN has addressed the issue of integrated health and care, there has also been increased representation from local authorities.

This conference will showcase innovations in digital products, services and research. We have two distinguished keynote speakers: Tracey Grainger, who will talk about technology in primary care, and Prof Ruth Chambers, who will highlight the importance of technology-enabled care for long term conditions. In addition, we have three guest speakers: Prof Simon Brake, Suma Surendranath and Dr Adrian Stavert-Dobson. The conference features:

• Thematic tracks
• Oral presentations
• Stands
• Poster sessions
• Networking reception

We would like to sincerely thank you for your support and participation in our event.

Kind regards,

Professor Theodoros N. Arvanitis
Head of Research, Institute of Digital Healthcare, WMG, University of Warwick
Co-Director of the Digital Theme, West Midlands Academic Health Science Network

and

Professor Sudhesh Kumar
Dean of the Warwick Medical School and Director of Institute of Digital Healthcare, University of Warwick
Acknowledgements

First, special thanks to all speakers, presenters and delegates for participating in the second WIN Conference!

We acknowledge the support of the West Midlands Academic Health Science Network and SAGE Digital Health Journal for publishing a selection of the conference papers.

Also, thanks to:

WIN team

Martin Rowland, Sallyann Edwards, Sarah N. Lim Choi Keung

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Ian Arrowsmith, Theodoros N. Arvanitis, George Despotou, Mark Elliott, Sarahjane Jones, Sudhesh Kumar, Sarah N. Lim Choi Keung, Neil Mortimer, Karen Pickavance, Ala Szczepura, Peter Ward, Andy Williams

Conference paper reviewers

Theodoros N. Arvanitis, Mart Elliott and Sarah N. Lim Choi Keung

Conference e-proceedings editing

Sarah N. Lim Choi Keung
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Keynotes and Guest Talks
The Fundamental Role of Technology in Transforming the NHS

Tracey GRAINGER
NHS England, Leeds, West Yorkshire, UK

Abstract

Primary care is evolving to meet the challenges currently facing the NHS and to deliver, in line with national policies and commitments, a health system that is paper-free at the point of care. Technology is fundamental to this evolution and brings benefits to both patients and healthcare professionals, empowering patients and improving access to services, reducing bureaucracy for professionals, making time and cost efficiencies, delivering greater equality in terms of standard of care provision and ultimately, improved health outcomes. NHS England is leading the development of a digital primary care strategy to support this evolution of primary care and drive patient engagement with digital services, address gaps in capabilities, align contractual and funding processes, embed digital services into everyday commissioning and encourage innovation at a national and local level.

Introduction

As Head of Digital Primary Care Development at NHS England, Tracey Grainger is responsible for the delivery of a Digital Primary Care service which ensures that the dual aims of improved access to services for patients, and reduced bureaucracy for GPs are met. Tracey is also leading the development of a children’s health digital strategy which works towards a child health service that is paper-free at the point of care and makes information relating to children’s health available and accessible to professional, parents, carers, children and young people. These important programmes of work are being undertaken against a backdrop of known challenges facing the NHS, including an aging population, increasingly complex patient diagnoses, a decline in the numbers of healthcare professionals, huge variations in outcomes and quality and changing user expectations.

Methods

The digital primary care strategy encompasses the work of a number of strategic programmes, highlighting and encouraging innovation via the Prime Minister’s GP Access Fund, and addressing the contractual and commissioning requirements that are needed to support the future vision and allow commissioners to be as informed and intelligent when purchasing technology as they are when purchasing other primary care services. There are extensive programmes of work being undertaken which enable data and information to follow the patient on their journey through services and to allow clinicians to access records at the point of care, particularly in addressing the underlying building blocks of common information standards and open interfaces, which allow systems and organisations to be interoperable. Patient consent to share, identification issues and data security must also be addressed in order to secure public trust.

Results

NHS England is leading the development of a digital primary care strategy to support the evolution of primary care strategies will outline the challenges that must be overcome if the NHS is to meet the current demand for digital services in the primary care and children’s health landscapes. The health and care economy must look ahead to the future and new ways of empowering patients to take more control of their own health and wellbeing.

Discussion

This keynote will outline the current health and care landscape and outline the ways in which people currently interact with services. Tracey will share a vision of the future and some insights into the work that is being undertaken to enable the health and care economy to achieve the future vision.

Conclusion

Transformation of the NHS is only possible if we embrace technology and continue to build on the good work that has been done so far. This is recognized at the highest level with key policy drivers such as the Five Year Forward View and the National Information Board’s Personalised Health and Care 2020, and although the transformation has begun, there is much work that is needed to support patients and professionals to build the basic digital skills required in this digital age.
Delivering Integrated Records – a Practical Perspective

Simon BRAKE
Coventry & Rugby GP Federation, Coventry, UK

Abstract
Primary care is seeking to deliver improved ways of working, consistent services, and better access to services, with shared electronic records and shared information at the heart of new models of care. Delivering this has required rapid innovation, clinical, organisation and technical consensus, and an enabling environment both nationally and locally. Improved patient outcomes and reducing clinical risk are the key outcomes, with achieving good use of resource and improved and sustainable system integration comprising the underpinning principles.

Introduction
Simon in Chief Executive of the Coventry & Rugby GP federation, a wave 2 Prime Minister’s GP Access Fund pilot covering a population of 480,000, delivering a range of new ways of working for primary care, with shared electronic records and care summaries at its core. These innovative patient services, which aim to improve outcomes, as well as make better use of existing NHS and system resources, are seeking to introduce consistent and improved access to high quality services for our population. As part of this, we are seeking to make primary care records available across the whole care economy through innovative and improved system design, across primary care and the acute setting, in order to deliver better informed, lower risk care, and ensure that detailed patient information is always available when needed regardless of the care setting. The federation is also seeking to support primary care in becoming the clinical destination and career of choice, using the leadership of local higher education partners to create a primary care academy, and to make teaching, learning and improvement the fulcrum for achieving improved patient outcomes.

Methods
Through implementation of our three new clinical schemes, and a rapid technology-based programme of records sharing, in conjunction with a health-economy wide consensus on the need to share information, we have sought rapid implementation of innovative solutions across the primary, community and secondary care environments. This has been within the context of a national programme, offering a highly permissive and liberated environment, as well as technical and procurement support, alongside political direction to deliver sustainable system change and improvement. Achieving an effective and sufficient consensus around the information sharing methodologies and agreements has been a core task, whilst ensuring that clinicians have sufficient access to shared records to deliver improved care has been equally fundamental. Finally, ensuring forward compatibility, or at the very least, consistent direction of travel with the likely medium-term technological system direction is essential.

Results
Primary Care is offering a “living lab” model of development, with significant innovations being delivered through rapid innovation, review and improvement. This is producing high levels of functionality and effective sharing of records and patient data across given geographies, whilst maintaining individual GP records at a practice level, and always delivering secure and confidential systems. The emancipation of clinical practice within shared service environments, through access to patient records, and the ability to update existing records and create new data is delivering new, improved and consistent services, and better outcomes for patients. The overall programme is subject to an independent academic evaluation of the final outcomes, which will be published.

Discussion
This plenary discussion will explore the context for the current diverse system development model of “a thousand flowers blooming” within the range of interoperability standards, alongside the desire for long term system integration, whilst contrasted with the need for immediate functionality. The discussion will also offer an opportunity to consider what constitutes integrated, sufficient, and adequate within the context of a desire to deliver safer and better patient care, and how much ugliness we’re collectively prepared to tolerate in the interest of better care.

Conclusion
Delivering improved outcomes for patients can only be achieved through achieving improved sharing of records and information. In order to achieve this rapidly, a permissive environment, within a broad policy framework, appears to be succeeding. It is dependent on local organisational and clinical consensus, which together can support rapid and effective innovation, and effective solutions that support towards a sustainably integrated future.
Integrating Technology in the Management of Parkinson’s

Suma SURENDRANATH
Parkinson’s UK, London, UK

Abstract
As a complex condition, it is often difficult to truly appreciate how Parkinson’s symptoms can be best managed and the impact of treatment on quality of life. Technology offers a means of understanding symptoms and supporting people with Parkinson’s to take control by engaging in activities to support their health. This presentation will look at how technology can be a beneficial adjunct to clinical management that benefits both professionals and people affected by Parkinson’s.

Introduction
Parkinson’s is a progressive neurological condition that affects 127,000 people in the UK1. It is caused by the loss of dopamine-producing cells in the brain and whilst it is typically associated with motor symptoms such as bradykinesia, rigidity, tremor and postural instability, it can also lead to a range of various non-motor symptoms including anxiety, bladder and bowel problems, sleep disturbance and pain2. Currently there is no cure and management is focused on controlling symptoms so that the person can have as full and productive a life as possible. However a challenge with Parkinson’s is that there are no clear objective markers to guide its management and so both the initial diagnosis and consequent treatment decisions are primarily based on clinical examination. Yet another complicating factor with Parkinson’s is that it is a fluctuating condition and so how people with Parkinson’s present at clinic reviews may not be representative of how their condition affects them in their daily lives. As a result, decisions regarding the best treatment for that person are not able to take into account the full complexity of their condition. Therefore there is a need to be able to collect continuous data that accurately represents a person’s physical capacity in an unobtrusive and objective manner to ensure that well-reasoned clinical decisions about treatment, that are appropriate for the individual outcomes of each person with Parkinson’s, are taken.

Being able to utilise technologies that enable this to happen could enhance management by potentially:

- Aiding a swift and accurate diagnosis (on the basis of known objective indicators)
- Offering more robust evidence of when changes in treatment are required (and therefore enabling more informed consideration of treatment options)
- Improving communication between the professional and the person with Parkinson’s (because of the need to triangulate measurements with current management and effect on everyday life)

Ultimately technologies offering access to information that better reflects the person’s experience of living with Parkinson’s could have significant benefits on many aspects of management from more effective symptom control and improved outcomes of the person with Parkinson’s to more efficient use of services as treatments become better aligned to the needs of the people utilising its provision. Parkinson’s UK was keen to evaluate the impact of integrating technology able to offer this kind of intelligence into clinical practice to determine if and how these benefits are realised in practice. Therefore a collaboration was initiated with Global Kinetics Corporation who have developed the PKG™ (Parkinson’s KinetiGraph™), an ambulatory assessment tool designed to capture such data.

The PKG™ is a measurement tool that provides continuous objective data about two key symptoms of Parkinson’s, bradykinesia and dyskinesia. It uses a wrist-worn device called the PKG™ Data Logger which utilises a precision digital accelerometer to collect movement data and a proprietary mathematical algorithm shown to reflect the occurrence of bradykinesia and dyskinesia3 to process the data to produce a report outlining levels of these movement dysfunctions throughout the time worn. As it also has a vibration-based reminder to prompt the person to take their levodopa-based medication, these levels can be assessed in relation to effectiveness of medication. As a result, the need for altering the current management plan can be determined on the basis of more objective evidence.

The purpose of this collaboration was to determine whether systematic use of the PKG across a range of Parkinson’s services could demonstrate how technologies such as this can support clinical decision-making leading to more effective management of people with Parkinson’s – this would enable the development of a best practice resource that could facilitate integration of technology into clinical practice by other services using the lessons learned from this project.

Methods
Following the development of a recruitment information pack, 74 Parkinson’s services were approached to be involved in this project. Eventually ten agreed to participate. Each site received training in the use of the PKG™ including how to use the Data Logger and how to generate and interpret the reports developed in response to use. A service evaluation template was created (and subsequently updated on the basis of feedback from the centres) with a view to capturing evidence about the use of technology in improving clinical management in relation to the following:
Improved control of symptoms

- More appropriate timings and/or dosages of levodopa-based medication
- Changes in medications used based on data collected on symptom presentation
- More appropriate introduction of advanced treatments based on data collected on symptom presentation
- Responsiveness to levodopa and therefore appropriateness of continuing treatment

Experience of people affected by Parkinson’s

- Improved adherence with medication routine due to prompting
- Increased confidence in medication routines due to continuous data collection
- Increased involvement in clinical decision making because of the need to correlate findings with experience
- Better understanding of symptoms

Impact on services

- Reducing need for emergency admissions due to poor symptom control
- Reducing need for/length of in-patient assessment because access to continuous data enabling more comprehensive assessment of a person’s symptom presentation
- More efficient use of out-patient appointments when focused on clinical need for review
- More efficient use of clinician’s time in managing clinical caseload

Data collection started in April 2015 and is due to be completed by June 2016.

Results

Whilst service evaluation data is still being collected, it is difficult to draw any overarching conclusions about the impact of using this technology in clinical practice. However there are examples of changes being made to medication routines to reduce incidences of bradykinesia that were affecting the person’s quality of life and of new treatments being initiated as the current routine has been found to be insufficient. Feedback from people with Parkinson’s who used the PKG™ Data Logger has so far showed that many found the device easy to use without impacting on their daily activities and that it reinforced the treatment decisions made, giving confidence to both them and their clinician. Completion of feedback from both the services involved and people with Parkinson’s will enable fuller conclusions to be drawn in time.

Discussion

Whilst it is too early to confidently outline the impact of using a technology such as the PKG™ in the management of Parkinson’s, some key lessons have been learnt about the common factors influencing successful integration of technologies into everyday clinical practice. These include the importance of stakeholder involvement in the process, the role of local champions with the motivation and standing to drive forward changes in practice and the need to consider the practicalities of how the technology will be introduced to the person and how conversations about its analysis will be managed. These issues and how they were managed have the potential to impact whether in reality technologies like this become embedded into clinical practice. However by being able to illustrate within a best practice resource how the services in this project overcame their challenges, the gauntlet is then set down for other services to pick up and take action so that technologies that have been shown to benefit both professionals and people affected by Parkinson’s become standard within everyday practice.

Conclusion

Technologies such as the PKG™ have the potential to revolutionise management of Parkinson’s however any firm conclusions to what extent this can happen will very much depend on the completion of this service evaluation.

References

1. Parkinson’s Disease Society. Parkinson’s prevalence in the United Kingdom 2009
Today’s Practical Challenges in Assuring the Safety of Health IT Systems

Adrian STAVERT-DOBSON
Consultant in Clinical Risk Management, Sheffield, UK

Abstract
Stakeholders in English NHS Trusts and Health IT system providers are required by NHS England to comply with Safety Standard ISB 0129 and ISB 0160. However, there is still lack of clarity in relation to the requirements and how they should be delivered. Many challenges are faced and the lack of a formal enforcement framework adds further complexity. Adrian Stavert-Dobson is one of the most experienced individuals in delivering to the standards. In this presentation he will highlight the key challenges and learning from the last decade.

Introduction
Healthcare professionals are increasingly reliant on information technology to deliver care and inform their clinical decision making. Health IT provides enormous benefits in efficiency, communication and decision making. However, a number of high-profile UK and US studies have concluded that when Health IT is poorly designed, sub-optimally implemented or incorrectly operated then patient safety can be compromised.

Health IT introduces new hazards if systems fail to make clinical data available or the information provided is misleading. When systems produce data which is wrong but still credible the perfect storm is formed. For example, in 2012 a three-year-old child with congenital heart disease died at Bristol’s Royal Hospital for Children. A newly installed computer system had failed to generate vital clinic letters relating to his care. The coroner concluded that, “Due to the failure of the hospital’s outpatient booking system, there was a five-month delay in [the child] being seen and receiving necessary treatment.”

Incidents such as these mean that manufacturers and healthcare organisations are increasingly required to demonstrate that their Health IT solutions are safe. In the UK, HSCIC and NHS England have mandated Standards ISB 0129 and ISB 0160 requiring manufacturers and healthcare organisations to carry out a structured risk assessment on Health IT products.

However, despite the standards being in operation since 2009, uptake has been patchy at best. Healthcare organisations are not clear what they should be asking their suppliers to do. Suppliers feel under attack; are they being forced to disclose valuable intellectual property and wash their dirty linen in public?

In this presentation, Dr Adrian Stavert-Dobson will share his views based on 15 years’ of experience operating in the industry.

Experience-based Best Practice
Dr Adrian Stavert-Dobson is Head of Clinical Risk Management at BT Global Services and the author of the first book on managing clinical risk in health IT systems. He manages the only Internet blog on the subject and teaches widely in the UK and abroad. Adrian is a medical doctor, computer programmer and health informatician. He successfully developed his first eHealth solution aged just 18 and went on to study Medicine at the University of Leicester. His passion for technology took him from clinical practice in anaesthetics to full-time Health IT working with a number of innovative software suppliers. A strong advocate for patient safety, Adrian has specialised in the management of clinical risk in Health IT systems. Working alongside professional safety engineers he has adapted techniques well-established in other safety critical industries to the healthcare domain. As Head of Clinical Risk Management at BT Global Services, his primary responsibility is to embed a working safety management system into the organisation’s product lifecycle and culture. He has presided over the assurance of national eHealth systems deployed into the world’s largest civil IT programme.

As the demand for improved risk management in Health IT has grown, Adrian has found himself consulting nationally and internationally on the topic. His passion for the subject is palpable and he often speaks about his experiences at national forums. In 2011 he was selected as an industry representative to consult on the UK’s development of national safety standards and acquired a role jointly chairing the safety forum of a major UK thinktank. He is an advisor to the British Standards Institute.

Discussion and Conclusions
Based on his experience in the industry, the author will summarise the UK standards relating to managing safety in Health IT and describe the practical barriers that healthcare organisations and suppliers face in complying with safety standards ISB 0129 and ISB 0160. Furthermore, he will outline the need for better education in Clinical Risk Management amongst clinicians in particular to support the critical customer to supplier language barrier. He will finally propose that there needs to be a cultural shift in the perception of safety in health IT from one of burdensome regulation to a framework for excellence and added value.
References


Technology Enabled Care is a Must for Delivery of Care for Long Term Conditions – Now!

Ruth CHAMBERS
West Midlands Academic Health Science Network, Birmingham, UK

Abstract
This presentation relays insights from those who have made technology enabled care services (TECS) happen in health or social care settings. It captures how organisational and frontline challenges have been overcome to achieve buy in by commissioners and managers, engagement with patients or service users, and adoption by practitioner users of TECS. The focus is on ‘how to do it’ – redesigning services, setting up support structures, making delivery of care happen in virtual ways.

Introduction
We need to learn from examples of good practice of technology enabled care (telehealth, telecare or assistive technology, video consultation/telemedicine including skype, apps and social media eg Facebook) around the UK and overseas. We must work to local strategies in health and social care settings to adopt and disseminate these applications for the delivery of care for long term conditions, focusing on the prevention and management of long term conditions and stimulating sustained behaviour change – professionals and service users.\(^1,2\)

Methods
The content of this presentation is derived from themes emerging from a general collation of evidence and reports relating to the delivery, commissioning, design and production of technology enabled care in health and social care settings.\(^3\) This included an overview of systematic reviews, evidence based publications, anecdotal reports, informal discussions, local projects, case studies and reflection.

Results
Organisational challenges
To take technology enabled care services (TECS) forward on a widespread from an organisational perspective we need to establish and support leaders and champions of TECS throughout the commissioning cycle to communicate the benefits and drive change. We must enable patient and public involvement & engagement; co-design of services and co-production of applications to drive person-centred, integrated care rather than standalone solutions.\(^4\)

We should focus digital delivery of care on areas in patient pathways where enhancing self care has a substantial impact on improving patients’ clinical outcomes and/or reducing avoidable healthcare usage. We must match the mode of digital delivery of care to suit the needs and preferences of individual patients and their characteristics. But we need to anticipate consequence costs such as increased frequency of clinician alerts, increased patient demand.

We have to train health and social care professionals; enhance workforce competences and capabilities and confidence levels, for the rollout of technology enabled care.

It must become general practice to rigorously/speedily evaluate any implementation or trial of TECS; using this information to underpin any future business cases.

The adoption of TECS should be via a quality improvement culture with professionals and managers utilising improvement tools to underpin commissioning and service improvement – leadership, transformational change, service redesign. Providers of TECS should work closely with all stakeholders to integrate technology in care to improve outcomes for all services; redress ongoing issues in constructive ways before progress with rollout is stalled.

Frontline perspectives
To succeed in widespread adoption of TECS that is sustainable from the frontline perspective we need to target prevention of long term conditions – especially in relation to poor lifestyle habits. Such prevention of deterioration of a long term condition as by better controlling hypertension makes consequences such as stroke or dialysis less likely. Good outcomes should help to convert practitioners who are negative about the use of TECS and who stereotype older people for instance as not being able to operate the end of digital care, to become more positive about TECS.

Patient education help individuals understand more about their condition and co-operate with shared management care plans; and can be relayed via TECS. So technology is useful for triggering patient reminders so that they are more likely to comply with interventions and adhere to regular medication. And technology underpins patient or service user safety with assistive technology for those who are frail.
TECS should be focused in ‘hot spots’ in patient pathways where clinical management can be improved and generate improved clinical outcomes. Comorbidity can be a challenge, but treating one condition (eg depression) can enhance the person’s health and wellbeing in respect of other parallel conditions (eg asthma) so that the patient’s overall health is improved; and technology enabled care can be designed for supporting two or more conditions focused on someone’s needs and preferences.

The evidence base is evolving to demonstrate that if we focus technology enabled care on the main strategic priorities in health and social care settings1 – we can show that successful remote delivery of care focused on long term conditions2-8: saves money (eg fewer unplanned hospital admissions, less medication wastage); is more convenient (for patients, carers and practitioners); enhances productivity of NHS or social care teams (eg fewer home visits or face to face consultations); enhances clinical outcomes (so people live longer in a healthier state)

Discussion

How can it be possible for frontline practitioners in health and social care to continue to blank opportunities to deliver care to their patients via digital means nowadays? When they themselves and most of the population (of all ages) use mobile phones, computers, email and telephone to interact with friends and family or buy goods online.

Why do commissioners and providers in NHS settings ignore digital healthcare at scale? Why do leaders in social care utilise assistive technology on an ‘ad hoc’ basis? Are they wary of the commercial market? Or unconvinced of the evidence for benefits of TECS? Or not willing to engage in redesign of heath economy wide patient pathways enabled by technology? Or find the financial issues too challenging – who should pay for the underpinning technology along the patient pathway that crosses different care settings? Or challenged by organisation-only computer systems that are too restrictive about data sharing between different health and social care teams?

The WMAHSN person centred care manifesto states that ‘person centred care is simply: Right care for the person’s (or carer’s) needs and preferences, delivered with dignity, compassion, sensitivity and respect, at the right time and place, with due regard to the person’s age and any cognitive impairment.9 Shouldn’t this drive us all in health and social care organisations to adopt and disseminate technology enabled care services on a widescale?

References

Oral Presentations
#DigitalHealth: Exploring Users’ Perspectives through Social Media Analysis

Soroosh AFYOUNI¹, Ahmed E. FETIT¹, and Theodoros N. ARVANITIS¹,²,*

¹Institute of Digital Healthcare, WMG, University of Warwick, Coventry, UK
²Warwick Medical School, University of Warwick, Coventry, UK

Abstract

In order to explore the role of social media in forming an understanding of digital healthcare, we conducted a study involving sentiment and network analysis of Twitter contents. In addition to examining users’ opinions we used sentiment and network analysis. Our findings indicate that keywords widely range from mobile health to wearable technologies and big data.

Introduction

The widespread availability of social media provides numerous opportunities for individuals to share their opinions and make it heard by thousands of others. This results in enormous amounts of raw data derived from users’ behaviours, such as who they follow, how they react to a subject and how others respond to their opinions. In this study, we aimed to analyse tweets that have been generated with the keyword #DigitalHealth through the use of sentiment and network analysis methods. Analysis of tweets in #DigitalHealth may help us to quantify the impact of new technologies on the area of healthcare.

Methods

We collected tweets that were identified with the key term #DigitalHealth for a total of 55 hours, over three working days (2nd, 7th and 8th of April, respectively, in 2015) in both the United Kingdom and the Eastern Coast of the United States of America. Acquisition periods were set in a way that British Standard Time (BST) working hours overlapped with Eastern Standard Time (EST) working hours. In each collection, 100 queries were taken in 16min windows, to ensure that the Twitter API rate limit was not violated. This summed up to 20,400 tweets gathered from 1,964 unique users.

Tweets Contents and Sentiment Analysis: Each collected tweet was pruned for duplications based on status IDs and common English words (using English Stop Words list). Then, frequency of each unique word was calculated, aiming to identify high frequency words, as they can reveal the themes of discussions. Sentiment Analysis (SA) is a metric that aims to quantify valence in text corpuses. In order to quantify the opinion of each status, SA was carried out on our gathered data by using AFINN† to score each word. In addition to this, all tweets were quantified with a single value called Net Sentiment Rate (NSR), which is the ratio of the difference between positive and negative tweets and total number of tweets. Network Analysis: To explore user and hashtag interactions, a directed two-mode network was constructed from our data. Nodes were defined as users and hashtags, while edges were between-node instances of mentioning. In other words, if a user mentions another user an edge would be formed between them. Similarly, if one of these users mentions a hashtag, an additional edge would be formed between the user and the hashtag. To reduce redundancy, related nodes (e.g. #app and #apps) were merged.

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† AFINN is a list of 2,477 English words, which had been rated with an integer based on its valance [2].
as a single one. We examined the network’s degree centrality: a measure of the number of connections coming in and/or out of a node. Degree centrality can be used to identify the network hubs, which are sets of nodes that have the highest number of connections and hence play a vital role in the flow of information in the network topology. As hashtag nodes are unable to mention other entities in the network, we just explored their in-degree centrality.

Results

Tweet Content and Sentiment Analysis: The frequency of words is illustrated on a scatter plot, as per Figure 1. The #mHealth, which represent the mobile-related health topics, was shown to have the highest frequency. Relative words such as app and apps follow it with relatively high frequency. The #WearableTech is the second highest-frequency hashtag, which is followed by #Wearables. It is worth noting that at the time of this study, Apple Inc. had announced its health-oriented wearable watch, which was the likely cause for highly repeated relative terms (#apple, #AppleWatch).

Although mobile and wearable technologies dominated the contents, other topics such as health information technology (HIT), big-data and innovation were heavily discussed. SA also revealed that, whilst most tweets were neutral (as they are centred on zero), their histogram was slightly skewed towards positive. This can be interpreted as a generally positive opinion in tweets about the concept of digital healthcare. It is worth noting that NSR is about 82%, suggesting that this percentages of the tweets were optimistic about the topic.

Network Analysis: We obtained the in-degree centrality of each hashtag and users, separately. In-degree, in this context, is an indication of the number of times a hashtag or a user has been mentioned. To aid with the visualisation, Figure 2 only shows in-degrees of 7% of hashtags analysed. Interestingly, the in-degree of Hashtags follows the power-law distribution. More simply, there is a small number of highly connected nodes in the network, while the other nodes suffer from low number of in-degree. Obviously, the #DigitalHealth has the highest in-degree as it was likely to be mentioned in the majority of tweets, but it is remarkable that other hashtags such as #WearableTech and #MobileHealth also formed in-degree hubs. These hashtags were also followed by other popular topics, such as #HealthIT and #BigData. Additionally, our findings suggest that leading companies in the area of wearable and information technologies contribute to numerous interactions within this network. For instance, #Apple and #Google were found to have high in-degrees.

Discussion

Our sentiment analysis findings suggest that public opinion on the topic of digital healthcare is generally optimistic and positive, since tweets included relatively more “attractiveness” than “aversiveness” words. The network analysis of these tweets also suggest that mhealth, wearable technologies and information technology are among the hub hashtags in network of interaction in the #digitalhealth. The methodology proposed above is not free of limitation as the sentiment analysis strategy is not covering all the words and it is also naïve in tackling tweets with more complicated contents.

Conclusion

Monitoring and analysing social media contents for these subjects can reveal popular topics of discussions and identify important influencers within the field. The topics that drew the highest attention during these three days were discussed extensively above. We also shown that how network sciences as well as sentiment analysis can deliver a better understanding of topics about digital health within social networks.

References

Addressing the Challenge of Integrated Care through Digital Technology

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Abstract

There is a need to constantly tackle a range of diverse and, sometimes, contradictory requirements of people with multiple chronic conditions. Integrated Care provides a potential solution to this need and digital technology can be the proposition for addressing its implementation challenge. Digital technology can support clinical teams to achieve care across all levels and provide independence in patients’ lives, by supporting them in enhanced and integrated activity within our societal structures.

Introduction

We are currently experiencing an increased occurrence of chronic diseases amongst the population. The World Health Organization estimates that 68\% of all annual deaths (~36 million people) is attributable to non-communicable, chronic diseases\textsuperscript{1}. Furthermore, chronic conditions are usually complex, rarely existing in isolation. Many people suffer from multiple conditions at the same time, a circumstance we usually refer to as multi-morbidity, making the management of their diseases a challenge for the healthcare system. As the life expectancy of people is improving, such a challenge becomes more critical for an individual’s health and wellbeing.

The Need

The clinical management of patients with multi-morbidity is much more complex and time-consuming, while it involves a multifaceted organisation of care provision across different healthcare stakeholders. Different healthcare professionals, community and home-care givers, and the patients themselves, need to be involved in a co-ordinated approach to care provision activities. There is, therefore, a necessity to equip all involved in chronic-disease management with new approaches and tools, which can empower our modern healthcare system in dealing with this need. The way we look at healthcare provision for chronic diseases has to radically change.

The Role of Integrated Care

At present, it is suggested that there is no ‘single model’ that can be applied universally to achieve care services for people with complex needs\textsuperscript{2}. Integrated Care, defined as “the management and delivery of health services so that citizens receive a continuum of preventive and curative services, according to their needs over time and across different levels of the health system”\textsuperscript{3}, can potentially provide such a co-ordinated approach.

Digital Technology as Solution

In C3-Cloud, recently funded EU Horizon2020 programme, we advocate that digitally-enabled approaches can provide more adaptive and radical solutions to the provision of integrated care. In particular, in the ever growing digital capability of our society, such technology can bring forward the power of information for an effective realisation of chronic disease management. An individual’s healthcare data, through the concept of electronic healthcare records, can be more readily available and provides a core facility in understanding the complexity of disease. Such data can also provide better insights for the whole patient journey in the context of chronic conditions. Quality digital healthcare data, combined with our current evidence-based medical knowledge, allows health and social care professionals to make more precise, informed decisions on care provision and patient support. Moreover, the transparent use of this information can empower the individual patient in their awareness of health and wellbeing.

Conclusion

The impact of digital technology and information can be transformative for healthcare. The benefits to individuals and society are multiple. People’s health journeys are better understood and appropriate lifestyle choices can be better tailored and promoted to the individual. In the case of chronic conditions, disease management can be more effectively supported and avoidable deaths can be prevented.

References

The Introduction of Computers into the NHS: Where Did It Go Wrong?

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Abstract

This paper examines the origin and introduction of large scale computer systems into NHS hospitals. It focuses on the confidentiality issues relevant to their design and the influences that lead to changes in the recording and dissemination of patient data. Finally it asserts that decisions made to abandon development by NHS employed staff created a significant space between those that used these systems day-to-day and those that specified and approved their design and content.

Introduction

At the end of the 1960s the Department of Health (DH) launched an experimental computer programme to develop healthcare systems for hospitals.1 The major projects accepted onto the experimental programme were at King’s College Hospital, Guy’s Hospital, the Stoke Hospital Centre, The London Hospital and the United Birmingham Hospitals. Also, a GP system was to be set up linking local doctors’ surgeries to Exeter Hospital. There were other smaller scale studies carried out at Cambridge, Charing Cross, St Thomas’s London, University College Hospital, Manchester, Hammersmith and Oxford. The medical, nursing and other staff who worked on these early systems intended that they would aid the care of patients and ensure a more ordered hospital environment.2 From the start they were concerned about the confidentiality of the information recorded and its ongoing use.3 As central authority exerted more control over the design of these systems confidentiality became an issue of concern as expressed by Higgs and others.

In his paper Continuity and Change regarding the General Register Office (GRO), Edward Higgs records one of the earliest attempts by government to use medical data for other purposes.4 Higgs notes that Edwin Chadwick, secretary to the Poor Law Commission, was instrumental in getting the 1836 parliamentary Registration Bill to include the cause of death for the establishment of Civil Registration of Births, Marriages and Deaths. Some of these other functions did, eventually, become less important but the availability of information concerning morbidity and mortality of the whole population, irrespective of their religious persuasion, was of great use to government and other bodies. This is a very early example of the use of medical information for other purposes than first intended. In his other work The Information State, Higgs notes that the medical data held by the GRO allowed local medical officers to gauge the efficiency of measures to improve infant mortality by local authority welfare and health services.5 These are early examples of the realisation by central authorities of the usefulness of medical data. Detailed aggregated medical data can be of great use to the state, but government use of this data has not occurred without some serious opposition from doctors and the BMA.6

In 1969 the BMA planning unit published a report from a working party on the use of computers in medicine.7 This report first reviews the capability of computers at the time and then reviews current clinical applications. It also deals with the controversial issue of storing confidential medical data on computers, pointing out that when Hippocrates formulated the Hippocratic Oath about keeping a patient’s information confidential, he had no extensive organisation to deal with. The report emphasizes two important principles that should be followed: firstly, that constraints should be clear and open to discussion, and secondly, that medical men (sic) should be involved at all stages of the development of medical computer systems.

The government attitude to who would determine the agenda was clearly illustrated by a paper presented by M.T. Caddick and D. T. Lee, both officers from the DHSS, to the first international conference on medical informatics, MEDINFO 74, detailing the department’s justification for its healthcare computer policy.8 They asserted that the DHSS had the responsibility to set the scale, objectives and priorities of healthcare computing. They should also guide ‘field authorities’ i.e. hospitals and clinics and help them understand the reasons for the allocation of resources and the justification of guide-lines.

The Younger report of 1972 maintains that any confidential information should be regarded as held for a specific purpose and not be used, without proper authority, for other purposes.9 The NHS code of practice regarding confidentiality of 2012 states that ‘A duty of confidentiality arises when one person discloses information to another (e.g. patient to clinician) in circumstances where it is reasonable that the information will be held in confidence’.10 The patient data collected by healthcare computer systems is clearly within these guidelines and definitions but what is aggregated and how it is stripped of its identifying details is very controversial. Those that want to release ‘anonymised’ patient data to the life sciences industry claim that it will help to save lives.11 Critics say that the data consists of a mixture of publically known information and private, health information so that knowing something of a patient enables them to be identified. Ross Anderson, professor of security engineering at Cambridge University, quotes the case of the press finding out about Gordon Brown’s eye operation from anonymised records.12

Methods

The information for this account was gained from the usual printed and online sources, papers in private hands of participants and from interviews of individuals who involved in the development of the early systems. Interviews were part of research for a Master of Research degree at Keele University and conducted according to the guidelines laid out in Graham Smith’s work on Oral History.13 Participants received a standard letter of invitation, a script that would guide the course of the interview and a consent
form for the interviewee to sign to agree that the interview can be used for research, as recommended by the Oral History Society. Interviews were recorded and lodged with the university library at the conclusion of the research.

Discussion
The early systems were designed by medical, nursing and computer staff working together and produced systems that were designed to assist with the care of patients and only secondarily its administration. As the government took more direct control over the design and specification of these systems they became more biased towards the recording and collection of management information so that the main purpose of these systems was often administration and control.

This is illustrated by the work of Mrs Edith Körner’s committee in 1982, (the NHS/DHS Steering Group on Health Service Information) report on the collection of healthcare data. During their fact-finding and research Mrs Körner and some members of her committee made two visits to the West Midlands in the early 1980s to see how the systems being developed there handled healthcare data. The unspoken problem with the Körner committee’s recommendations when they finally appeared was that they aided management and contributed very little to the clinical practice of nurses or doctors. Sir Douglas Black, then President of the Royal College of Physicians, indirectly pointed this out in an article in the BMJ in 1982. He noted that the information collected by the Körner recommendations was limited to the information required by management about clinical facilities in hospitals and the patients using them. He also said that leaving out some personal patient data that would have assisted doctors in their research ‘is a matter of fine judgement’, clearly a seasoned government employee’s critique of the Körner committee’s data specifications. Sir Douglas’s contribution was referred to as ‘the witty, lucid, leading article’ by two specialists in child and adolescent psychiatry, when they complained about the medical deficiencies of the Körner recommendations in their specialty in a letter to the BMJ at the start of 1983. They understood his damming by way of faint praise and mild query.

By the end of the 1980s many of the scientists and technicians with experience of working with doctors and other health staff had their jobs outsourced as regional health authorities were dismantled. Thus the legacy from the earlier, government funded research was dissipated instead of being available to develop the hospital systems required in later years. This change meant that, subsequently, many health service institutions had to rely on external IT consultants who were often unfamiliar with the needs and working practices of hospitals and their staff, and their brief was often more related to government needs rather than hospital ones.

Conclusion
The early pioneers of healthcare computing promoted and supported computer development as they had the vision to see that these systems had the capacity to improve patient care. This did not stop them, or others, being concerned about the confidentiality of the data these systems held, or the question of who would have access to it. When the Regional Health Authorities ceased to exist, the management of confidentiality passed to central government and out of the control of local healthcare agencies. The recent development of Myhealth by Queen Elizabeth Hospital Birmingham, free of government control, restores some of the aims of the original pioneers and should help to regain the confidence of patients that their health records will not be shared with external authorities.

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Bosch Health Buddy® for Monitoring Cancer Patients on Chemotherapy and Biological Therapy

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Abstract
Patient reported toxicity measures are possibly a more accurate reflection of chemotherapy related side effects than clinician elicited responses. The ‘Health Buddy®’ is a user-friendly, web-connected device installed in the patient’s home. It transmitted data on effects of treatment and quality of life to the healthcare team. It also provided patient education which encouraged self-management. The management of cancer patients on treatment, as outpatients, provided an ideal opportunity for remote monitoring to improve patient care.

Introduction
Information Technology (IT) can be used to ensure better communication between patients and care providers to maintain quality of care and reduce cost (Blozik et al.). Driven by IT, telemedicine strategies include nurse-led follow-up clinics, video-conferencing, mobile phone use and web based applications. These have all documented improved patient self-sufficiency and a timely delivery of medical care. The aim of this study was to use a small device called the Health-Buddy® to remotely monitor patient’s health, during chemotherapy, in their own home. The intention was that timely intervention could help manage the side effects of chemotherapy and prevent them from worsening and hence reduce NHS costs.

Methods
Patients with a histological diagnosis of non-haematological malignancy who were due their first cycle of chemotherapy or biological therapy were recruited from outpatient Oncology clinics. Patients needed to have sufficient dexterity, no visual impairment and be able to read and write in English to partake in the study. Once recruited engineers were sent to patient houses to install the Health-Buddy®. The patients were required to undertake a daily questionnaire relating to clinical symptoms, knowledge and health behaviours. Each response was categorised into high, medium, low and no risk. High risk alerts were sent through to healthcare professionals at the University hospital. The team reviewing the alerts consisted of two acute oncology nurses and a healthcare assistant. Each high-risk alert required same day action. A team member would call the patient and enquire about the symptoms that triggered the alert and provide appropriate advice over the telephone or arrange a medical review or admission as appropriate.

Results
A total of 73 patients were recruited to the trial, 40 females and 33 males. Patients had the buddy for an average of 5 months. Patients with a variety of malignancies were included in this study, see Graph 2. Out of a total of 119,315 responses in total, 1,247 of these were recorded as high-risk alerts which required healthcare advice. The most common severe symptoms encountered by patients included fatigue, pain, emotional distress and severe diarrhoea (6 or more times in one day), see Graph 1. Available data on action taken to close high-risk alerts has been compiled from the UHCW oncology patient management system MOSAIQ®. Available data from 67 patients indicates that over the period of the study, alerts from the buddy required at least 444 phone calls. There were also 29 emergency reviews and 33 hospital admissions possibly related to buddy alerts. There was a positive response from the patients to the health buddy but data on patient satisfaction is unfortunately currently unavailable.

Discussion
The use of telehealth in medicine is expanding. A recently published Cochrane review included 93 eligible trials with 22,047 participants evaluated the effectiveness of telehealth in a variety of clinical conditions. Chumbler et al. and Head et al. have previously studied use of this device in cancer patients in the United States before ownership passed to Robert Bosch Healthcare. Chumber et al. used this device in a matched case control study with 43 patients and 82 matched controls under the Department of Veterans Affairs. Patients had significantly fewer preventable clinic visits, all-cause hospitalisations and chemotherapy related hospitalisations than the control group. This study offered preliminary evidence for successful use of this device. In another study of this device by Chumbler et al. of 34 cancer patients, showed that after adjusting for demographic and clinical factors, there was...
a 6.5 point increase in health-related quality of life (HRQL) score between the baseline and end of treatment with use of the device which was felt to be clinically important. Head et al.4 in a study of 75 Head & Neck cancer patients where the device was used as an adjunct to routine support in 42 patients, found that the device was favourably received and appeared to be a beneficial aid to routine care. Using alternative technology, Keamey et al.6 studied a group of cancer patients where a mobile phone based automated symptom alert system for chemotherapy-related symptoms found no difference for four out of six symptoms between patients using the automated alert system and usual care of symptom management.

This study was intended as a pilot project towards a larger study with a more thorough analysis of the utility of the Health-Buddy® planned. Unfortunately, Robert Bosch Healthcare was liquidated before completion of our study so return of all the Health-Buddy® devices was required. The clinical data sent to us by Bosch was incomplete and we have been informed that the original complete database is not accessible. This has proved a considerable challenge and represents a limitation in relation to the current results. We are still making efforts to obtain the missing data. From the available data we were able to surmise that patients were accepting of the health buddy and that the use of the buddy generated a large number of high-risk alerts necessitating action from the medical team. The two important areas in which data is lacking is information on patient satisfaction with the Health-Buddy®, and alerts relating to the symptom oral mucositis.

This pilot study has made a couple of important issues clear to our team and do need to be taken into consideration in the planning of future telehealth projects for continuous monitoring of cancer patients on treatment. First and foremost any telehealth solution must be based on mobile or tablet technology, this will be the most cost effective and easily accepted platform. Also a fully staffed, Acute Oncology nursing team will not be sufficient without additional resource to deal with the volume of alerts generated. This is primarily due to the emotional distress experienced by cancer patients which resulted in a large number of alerts generated. A more efficient use of telehealth in cancer patients would be to devise a solution to replace some pre-chemotherapy consultations in patients tolerating treatment without significant toxicity or to replace follow-up appointments for patients that have successfully completed treatment and need ongoing surveillance.

**Conclusion**

Despite its limitations this study highlights the potential for a telehealth solution in the care of cancer patients. Our study shows that patients were amenable to utilising the device and that the device did provide additional support during chemotherapy.

**References**

Standards for Telehealth Services

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Abstract

Telehealth services are developing in different ways (embracing mHealth, medication compliance, telecare, vital signs monitoring and activity monitoring). The need for appropriate service standards, norms or codes has never been greater. This presentation explores a selection of standards by reference to experience in different European countries, North America and Australasia. Emerging trends in their development are identified that point to their increasing flexibility; and their evolution in a way that may help to foster a move away from ‘top-down’ prescriptive and towards more integrated approaches.

Introduction

Telehealth services operate in a number of domains including mHealth, medication compliance, telecare, vital signs monitoring and activity monitoring. It can be approached from two different directions – from clinical health or social care. Each of these has histories, traditions and professional dogmas that have been re-enforced by standards, norms or codes (henceforth standards). The standards have given us some of the certainties that frame our personal or professional lives and give us our ‘comfort zones’. But telehealth cuts across such certainties. It follows that the role of standards as we know them (and which may reflect one or other of the health and social care approaches) must be questioned.

Methods

This paper reports on some initial findings of research into telehealth related standards in different European countries, North America and Australasia. It begins to give shape to what Krupinski and Bernard referred to as ‘differences in approaches and norms for conducting telehealth’¹ and responds to what the European Commission lamented as the ‘lack of regulation at the EU level’.²

A key objective in the research was to explore the content of the standards and explore the way in which they

(a) help or hinder telehealth service development (by reference to their content and the degree to which they prescribe certain ways of operation); and
(b) support particular (changes in) attitudes and the process of integration between health and social care.

From the social care perspective the standards explored extend from the early offerings of the British Standards Institution from 1987 to the Telecare Services Association’s ‘Integrated Code for Telecare and Telehealth’ released in 2012 (under review at January 2016). The United Kingdom, it can be noted, were early pioneers with regard to telehealth – at least in those elements that relate to social alarms and telecare. Other standards that can be seen as emanating from a social care direction (around social alarms and telecare) are noted from Australia, France, the Netherlands, New Zealand and Spain.

From the clinical health direction the focus is on ‘home telehealth’ where standards have been promulgated from 2002 by the American Telemedicine Association (ATA) through to their 2014 ‘Core Operational Guidelines for Telehealth Services involving Provider-Patient Interactions’. In addition it is necessary to note the ISO 2014 International Standard on ‘Health Informatics. Telehealth Services: Quality Planning Guidelines.’

Results

From the social care side of things it is clear that ‘standards thinking’ around telehealth has focused on social alarms, telecare and emergency responses. That thinking has been, in large, focused on service ‘operation’ and a particular way of doing things. A similar ‘operational’ perspective is evident from the clinical health side of things in ‘home telehealth’. But with regard to the latter it is significant that the ATA has maintained awareness of the broader social care agenda – and, with this, has held to a somewhat less prescriptive standards approach.

Overall, the extent to which standards are prescriptive is evident from, first, the degree to which operational procedures as opposed to service outcomes are specified; and, second, whether (and the number of) readily quantifiable ‘performance indicators’ are included. In addition, the extent to which standards reflect attitudes that encourage more integrated service approaches is signalled both in standard content and in language – with integrated approaches tending to eschew the term ‘patient’ in favour of, for instance, service user.

Discussion

In examining the range of standards, three trends are indicated.

First is the trend towards standards that are more flexible. There is, therefore, less emphasis on ‘how to do it’ and ipso facto less prescriptive operational approaches. The exceptions are for particular telehealth-related ‘tasks’ such as virtual visits, or in relation to technical requirements that demand, for example, the continuous availability of communications networks. This means that, at
least in part, standards appear, in the range and content of individual clauses, to be increasingly allowing for different telehealth service approaches. This can be argued as important in order to accommodate the way in which new technologies are becoming available; and to help foster innovations in service development. Within such ‘more flexible’ standards there is, as a consequence, less emphasis on specific performance ‘indicators’, albeit that services may be called upon to report openly on their performance.

Second is the trend away from top-down approaches that have reflected views of telehealth that may have been driven more by the interests of professionals (within service provider organisations, manufacturers and suppliers) than service users. This trend relates, in part, to the advent of new and cheaper technologies (including those relating to mHealth) that mean service users are accessing health and related support services in new ways. It also relates, in part, to a consumer-driven agenda where people (all ages) are more and more assertive with regard to their needs and service choices.

Third is the trend towards service integration – something that is particularly strongly championed by the European Union (as, for instance, exemplified in the EIP AHA – the European Innovation Programme in Active and Healthy Ageing). The EIP AHA sees the need for a break-down in the barriers that are extant in some European countries - not just between health and social care but also between primary and secondary healthcare. Those barriers are seen as thwarting the provision of more user-driven service approaches. Telehealth and related technologies, supported by appropriate standards, are seen as contributing to overcoming the barriers.

**Conclusion**

The nature of standards for services in telehealth is evolving in a way that, at least in the medium term, holds the promise of more flexible and less prescriptive service approaches. The relevant standards that have been put in place since the 1980s are few in number. Many can be seen as relevant in some specific service areas but as restrictive in a context where telehealth services are seen as a possible means by which barriers to innovative service development can be overcome. Trends are beginning to be evident, however, that suggest that standards, as they evolve, will increasingly support more flexible telehealth service approaches and that that these may help them to fulfil a more meaningful ongoing part in health and social care.

**References**

Using Insight to Improve NHS Services

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Abstract

The NHS has changed with its new organisations and ways of working; but many things are consistent, things like the need for high quality insight and involvement services. Midlands and Lancashire CSU have worked with their CCG partners to develop an innovative new approach to public and patient involvement, based around their Insight database.

Introduction

The NHS has changed with its new organisations and ways of working; but many things are consistent, things like the need for high quality insight and involvement services. These services, if delivered in a systematic way, can provide patients and the public with the opportunity to have meaningful involvement so that they are integral to the decision making process.

The communications and engagement team at NHS Midlands and Lancashire Commissioning Support Unit has worked with our emergent Clinical Commissioning Groups and we have developed a systematic approach to public and patient involvement that has its roots in the systemic review of cause and effect.

Methods

This approach is achieved by using an Insight database which collates, aggregates, analyses and reports quality data in real time to CCG staff based on their commissioning portfolio.

Our Insight database is used to record all types of patient experience feedback including feedback from focus groups, consultations, surveys, social media, Patient Opinion, NHS choices, media, MP letters, PALS and complaints. The database categorises the feedback under five domains of patient experience and allocates it to the provider of the service. Each of these five domains has a sub-subject beneath that enables the specific theme to be captured. This allows a picture of provider performance via real time patient experience dashboards making the information available to CCGs, contract management and quality staff within the CSU as well as colleagues at the NHS England local area team for Staffordshire and Shropshire.

Further information about the Insight system is available through the Midlands and Lancashire CSU website.

Results

All data is reported by CCG, however through data sharing agreements data can also be shared across multiple CCGs to use data at a practice or provider level. This data can be integrated at organisation, department, service, specialty, and ward or person level. The Insight database has been transformed into a quality system by entering clinical feedback from GPs and by reporting incidents/events in primary care settings. All data comes together and is reported in real time to identify themes and trends across the quality spectrum.

Discussion

This holistic approach has been pioneered by Stoke on Trent CCG in Staffordshire and Fylde and Wyre CCG as our first partner in Lancashire. We are working with voluntary sector groups and the NHS England Staffordshire and Shropshire Local Area Team to provide access to wider primary care and third sector feedback.

Conclusion

Our approach to insight and involvement receives lots of interest from CCGs, CSU, local HealthWatch organisations, acute, community and mental health providers as well as local authorities. The potential to use data across this wide range of organisations would go a long way towards understanding the voice of local patients and the wider public across the transformation and integration agenda. We are also working with the local Health and Well Being Boards to share intelligence and patient experience of services.

References

Is There a Need for Renal Computerised Clinical Decision Support in a University Hospital Setting?

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Abstract

A baseline audit to explore if CCDS is needed when prescribing for patients with renal impairment in a University Hospital setting. We aimed to identify prescriptions that did not adhere to dosing guidelines from the Renal Drug Handbook. Regular prescription data was captured, refined and analysed from the hospital EPMA system. We concluded that there is scope for the implementation of CCDS which may have a positive impact on prescribing adherence and patient safety.

Introduction

Electronic Prescribing and Medication Administration (EPMA) systems are being implemented across a number of hospital sites in the UK. With these come a number of digitally mature capabilities such as Computerised Clinical Decision Support (CCDS). CCDS systems match individual patient data to a computerised knowledge base using software algorithms to generate patient-specific recommendations.

In this study, we describe a baseline audit undertaken to explore whether there is a need for CCDS to guide practitioners when prescribing for patients with renal impairment. We aimed to identify prescriptions that did not adhere to the dosing guidelines outlined in the Renal Drug Handbook.

Methods

A number of ‘high-risk’ drug or drug classes have been identified that may need to be avoided or adjusted in patients with renal impairment.\textsuperscript{1} For each of the drugs, we captured regular prescription data from the University Hospital Birmingham NHS Foundation Trust EPMA system (PICS).

The following data were extracted for all inpatient episodes over a 12-month period (2014-15):

- **Prescription details**: drug name, form, dose, frequency, route, time prescription generated, and grade of the prescriber.
- **Patient demographics**: estimated Glomerular Filtration Rate (eGFR) prior to the first and last administration of the medicine, and the speciality the patient was under when the prescription was generated.

The first and last dose for each prescription were coded to identify whether the treatment was consistent with the guidelines in the Renal Drug Handbook.\textsuperscript{2} Cases of non-adherence were coded as a ‘dose discrepancy’, which may have been sub- or supra-therapeutic depending on the patient’s eGFR.

We also analysed the data to explore a number of temporal (time of day, day of week, month of year), patient (eGFR, speciality) and prescriber factors (grade). Comparisons of dose discrepancy rates across factors were performed using Chi\textsuperscript{2}-tests.

Results

Out of the 72 high-risk drugs or drug classes that need to be avoided or adjusted in renal impairment,\textsuperscript{1} data were available for 25 drugs from PICS (accounting for non-formulary medicines, or medicines that were not prescribed on a regular basis).

A total of 63,214 regular patient prescriptions were captured from the PICS audit database. Of these, 58,295 (92\%) patients had an eGFR that did not warrant a change in the dosing regimen, and 850 prescriptions were excluded as the patient only received one regular dose. This left 4069 prescriptions for analysis, out of which 656 (16\%) had a first dose discrepancy and 648 (16\%) had a last dose discrepancy.

We found the rate of dose discrepancies changed significantly across the time of day, patient eGFR and speciality (see Table 1).

Out of the 25 drugs analysed for dose discrepancy, morphine sulfate was the most frequently prescribed (n=1233/4069, 30\%), and 18\% had a first dose discrepancy, increasing to 21\% for the last dose (see Table 2). There were cases where drugs continued to be prescribed despite being contraindicated in renal impairment, in particular the Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) ibuprofen, naproxen and piroxicam (N=50, 1\%).

Discussion

In this study we found that dose discrepancies do occur in patients with renal impairment, albeit at a low rate compared to the total number of prescriptions generated on a daily basis. The decrease in the rate of prescriptions throughout the day may be attributed to a difference in workload in the evening. As eGFR nears normality, the number of discrepancies increase. This is a likely due to increased difficulty in classifying whether a patient would benefit from an avoided or adjusted dose. The rate did not change across the grades of the prescriber, which may indicate the decision is one discussed as a team, and that training or interventions to improve
prescribing in this patient group should be targeted at all prescribers. Patients under the surgical specialities (ear, nose and throat, neurosciences and plastics) were found to have the highest rate of dose discrepancies, but had a lower opportunity for error owing to the number of prescriptions generated. This may identify a need to focus training or any initial implementation of CCDS at specialities that may prescribe fewer drugs that are cautioned or contraindicated in renal impairment.

**Conclusion**

Improving adherence to prescribing guidelines in renal impairment would have a positive impact on patient safety, and this may serve as evidence for the implementation of CCDS. We are currently in the process of deciding how to implement this intervention. To establish whether this CCDS intervention could be used to increase adherence and improve patient safety, we will carry out a post-implementation audit.

**We would like to acknowledge the West Midlands Academic Health Science Network for financial support for this work**

**References**


The Framework for Compassionate Interpersonal Relations in Health and Social Care

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Abstract
Despite compassion being a key area of concern in healthcare, there is a lack of shared understanding of this term. In this study, 45 academic staff, health care students, clinicians and services users took part in focus groups in which they defined and discussed compassion. Following thematic analysis, the Framework for Compassionate Interpersonal Relations was developed with five stages, each of which requires practitioners' concerted efforts, energy and the application of a range of skills.

Introduction
Compassion has become particularly important in the context of health and social care provision. The highly publicised failures to provide care to ill and vulnerable people such as at Winterbourne View (DOH 2013) and Mid Staffordshire NHS Trust (Francis 2013) has led some to conclude that there is a ‘crisis of compassion’ within the NHS. Indeed, the issue of compassion has been high on the Government agenda for some time (Hehir 2013). For example, the Prime Minister’s Commission on the Future of Nursing and Midwifery (DoH 2010) urged the professions to make a pledge to deliver high quality compassionate care. The Chief Nursing Officer’s (DoH 2012) ‘Compassion in Practice’ strategy detailed a set of six values and behaviours essential to compassion in practice and to improving the culture of care.

Compassion, however, is a complex phenomenon and although it is an oft used word, it is a subjective criterion that is not well articulated. This is largely because the word compassion is used linguistically to refer to a range of acts, rather than a single one (Sturgeon 2010). For example, compassion may include empathy, respect, building relationships with others, and ‘being with’ another person at a time of suffering (Firth-Cozens and Cornwell 2009). Compassion may also come to light in different contexts and mean different things to different people at different times (Dewar 2011). Indeed, each person may possess a different understanding of what the word compassion means, although it has been argued that it is a construct that is distinguishable from other concepts such as ‘sympathy, empathy and pity’ (der Cingel 2009). The aim of this project, therefore, was to explore the perspectives of stakeholder groups to identify a common understanding of compassion, which led to the development of the Framework for Interpersonal Relations.

Methods
A ‘pragmatic’ qualitative approach was adopted, which is a practical method that seeks understanding of people’s descriptions and interpretations without being wedded to either an ethnographic, phenomenological or grounded theory approach (Savin-Baden & Major 2013). Forty-five academic staff, health care students, clinicians and service users participated in nine focus groups. A discussion schedule was developed specifically for the project, following a review of the literature. The schedule was reviewed by a project advisory board of the research team, University health- and social care staff and lay members of a Research Support Volunteer Panel. Two questions formed the main core of the discussion: how would participants define compassion; and, what behaviours indicate that a health care professional is compassionate.

Results
Four overarching themes were drawn from the data. The first theme centred on the participants’ definitions of compassion, while the second identified compassionate behaviours. The third theme related to the barriers and threats to compassionate practice and the fourth, focused on ways to support compassion in practice. Participants believed that the healthcare staff should be ‘consistently compassionate’, and were emphatic that compassion should not be substituted with a ‘care without engagement’ approach. Participants held clear expectations regarding practitioners’ communication skills and used these as a proxy for compassionate practice.

The ‘Framework for Compassionate Inter-personal Relations’ was developed from the data with the following five key stages.

Stage 1: Connecting, where the compassionate practitioner engages and connects with the patient by giving his/her full attention, using active listening skills, positive nonverbal communication skills and appropriate verbal skills.

Stage 2: Recognising feelings For genuine compassion to be experienced by the patient, these feelings need to include empathy and concern for the patient, his/her situation or difficulties.

Stage 3: Becoming motivated, where feelings of empathy and concern for the patient are harnessed as a desire to help or a force for action to support the patient.

Stage 4: Taking action to help, where the professional implements the plan of action, draws on personal agency and experiences and the support of others to help the patient.

Stage 5: Sustaining relationships, where the professional continues to use the skills from stage 1 to sustain the positive relationship with the patient and supplements these by providing the patient and relevant others with information, ongoing explanation and involving the patient.
Each stage of the cycle requires the practitioners’ concerted effort, energy and the application of a range of skills.

Discussion

The findings support previous research that has identified the link between empathy, compassion and the importance of establishing meaningful connections with others. Style of communication, whether an individual invested time in developing a positive interpersonal relationship, and level of personal engagement was used by participants to determine whether a practitioner was compassionate or not. Care given without personal engagement was viewed as non-compassionate. The findings of the study should be interpreted with care, since the number of participants from each stakeholder group was small and representative of a fairly small geographical area in the UK; hence the findings might not be representative of these stakeholder groups nationally. Nevertheless, the views across the stakeholder groups were similar, indicating some level of shared agreement. Compassionate care was seen as an important goal, even though participants in the study recognised the pressures of health care work and accepted that the expectation of ‘consistent compassion’ was not necessarily realistic. Care is needed to avoid a mechanistic, simplified view of compassion, rather than compassionate relationships centred on patients’ needs; hence this framework may be of value.

Conclusion

Participants held clear expectations regarding practitioners’ communication skills and used these as a proxy for compassionate practice. The ‘Framework for Compassionate Inter-personal Relations’ may be used to promote reflection on the implementation of compassionate practice and highlight areas of focus when conducting values-based recruitment activities.

References


Vision for Technology Based Interventions for Urgent and Crisis Care in Mental Health

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Abstract

A streamlined system for those in need of urgent mental health care. The system introduces predictive technology and digital interface solutions (in addition to a service innovation) to dramatically improve the outcomes and experiences of patients, their families and supporters. If achieved, this could lead to a reduction in the incidence of mental health crisis due to a clearer, more integrated, predictive and preventive system of support in the pre and post crisis phases.

Introduction

Birmingham and Solihull Mental Health Foundation Trust excel at service development and have a proven track record in delivering innovation. This includes award winning developments such as RAID, Street triage, Psychiatric Decision Units and Place of Safety. Branching into technology enabled care we have an advanced level of digital maturity having successfully implemented electronic patient care records, e-prescribing, mobile working and digital dictation, and have developed apps to support the recovery of our service users. The Trust is forward thinking and keen to continue in its innovative approach to patient centred care. One of the current and common concerns faced by all Mental Health Care providers is around the delivery of urgent and crisis care. Across Birmingham and Solihull approximately 25,000 people access mental health urgent care services every year. Feedback from staff, service users and their families suggests that crisis access points remain disconnected, difficult for patients/families to utilise and play no role in crisis prevention. This results in duplicate assessments, increased pressure at the acute end of the pathway, confusion and frustration and inefficient use of resources. These challenges are replicated nationally and were recently echoed by the National Crisis Concordat. To overcome such barriers, digital technology and service innovation need to combine forces to lead the way in efficient urgent crisis care.

Methods

Our vision is to enhance and integrate existing crisis care services currently provided by Mental Health and Acute Trusts, the ambulance service and justice systems to create a streamlined and efficient system for service users in mental health crisis. The introduction of predictive technology and digital interface solutions (underpinned by service innovation in the form of an urgent care coordination centre) will be at the heart of the new system. The coordination centre will be the hub, bringing together a variety of innovative approaches to patient management. The innovations include:

- Predictive analytics technology to identify who is at risk of crisis (technological innovation)
- A coordination centre to respond to those at risk of crisis not just those in crisis (service innovation)
- Live capacity and demand mapping (utilising health data)
- Patient portal hosting shared early warning signs/crisis intervention plan and self management tools (digital innovation)

To ensure the innovation has scalability and true value in wider health care application, it will be evaluated against the following hypotheses:

1) The implementation of a crisis coordination centre for mental health will increase satisfaction, wellbeing and quality of life in patients who are frequent users of services.
2) Providing preventative interventions to those identified (using predictive technology) ‘at high risk of crisis’, reduces the use of crisis services.
3) Implementing specific digital innovations (such as shared early warning signs, crisis intervention plans and self-management tools) reduces the use of crisis services.
4) The crisis coordination centre will lead to significant savings across the system, through reductions in emergency psychiatric admissions, psychiatric patients admitted out of area, patients presented to A&E in mental health crisis, police involvement in mental health crisis and episodes of despatched ambulance in mental health crisis.

The independent evaluation will adopt a mixed methods approach, gathering qualitative and quantitative evidence from sources including, data analysis, stakeholder surveys, in-depth interviews, financial information and case studies. The evaluation will run in conjunction with the implementation of the innovation. Baseline data collection (including HES and SUS data) will occur prior to implementation and continue throughout implementation with quarterly interim reports provided. Subject to scoping and planning phases we intend to begin with the top 10% of those most frequently using crisis services, followed by a wider field test.
Results & Discussion

It is hoped that the streamlined system will lead to a reduction in the number of episodes of mental health crisis which will in turn lead to reduced costs for commissioners and tax payers. We also anticipate improved satisfaction and experience for patients, families, staff and referrers.

The actual direct benefits we expect to deliver are an overall reduction in the following:

- Emergency psychiatric admissions to local psychiatric wards
- Psychiatric patients admitted out of area
- Inappropriate psychiatric patient admissions to acute hospitals
- Number of 4-hour A&E breaches related to mental health
- Patients presenting to A&E in mental health crisis
- Police involvement in mental health crisis incidents
- Episodes of dispatched ambulance for patients in mental health crisis
- Number of patients assessed under section 136
- Number of mental health crisis episodes
- Serious Incidents due to mental health crisis
- Complaints by patients and relatives related to dissatisfaction with mental health crisis care interventions
- Staff burnout and turn over (9 months post coordination centre launch)

We believe these benefits (including the ability to provide improved services at lower cost) will be demonstratable approximately six months after implementation.

Conclusion

Through better involvement and more effective communication we anticipate improvements in patients, families, referrers and staff satisfaction and experience. We expect staff to be more competent at managing crisis, patients to become more expert in self-managing their condition, families to be aware of available support and referrers to be more involved in patients access to the most appropriate services pre, during and post crisis.

As a result of a, more integrated, predictive and preventive system of support in the pre-crisis and post crisis phases, we anticipate there will be an overall reduction in the incidence of mental health crisis. Further benefits will be realised in the above areas when the predictive analytical tool (designed by our industry partners) has undergone sufficient testing and is fully operational.

It is envisaged that our industry partners will be able to commercialise their products in other areas of the NHS and internationally which will in turn ensure the innovation benefits are shared across the wider health economy.
The Role of Informatics in Prehospital Emergency Resuscitation and Defibrillation

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Abstract

Out-of-hospital cardiac arrests account for a large number of deaths as the time window for successful resuscitation is very short. Timely call for help, resuscitation and defibrillation by laypersons are crucial for the survival and outcome of cardiac arrest victims. Good quality data and informatics play an important role in the effectiveness of the chain of survival. Information about defibrillator location is vital for emergency services to direct bystanders; informatics also helps to strategically place defibrillators for optimal use. Technologies, such as location-based systems are being used to keep track of defibrillators and also alert volunteer responders to emergencies. Informatics also plays a role in post resuscitation care and research by facilitating the linkage and interoperability of health data between different systems, such as ambulance service, hospital, and other health data such as cardiac arrest registries.

Introduction

In 2013 the emergency medical services (EMS) attempted to resuscitate approximately 28,000 cases of out-of-hospital cardiac arrest (OHCA), in England alone1. If more bystanders had the confidence and skills to call 999 quickly, deliver effective cardiopulmonary resuscitation (CPR) until the EMS arrive, and when appropriate use a public access defibrillator (PAD), the number of cases where the EMS could attempt resuscitation, and so save lives, would increase. The overall average survival to hospital discharge from the 28,000 EMS-treated OHCA in England is 8.6%, which is significantly lower than in other developed countries, such as North Holland 21%, Seattle, USA 20% and Norway 25%. PAD use is still low in OHCA, for instance, in the south of the UK, 1.75% was reported in 20122 and internationally, PAD use has been reported in between 0.5% and 4.9% of OHCA. In the event of a cardiac arrest, every minute without CPR and defibrillation reduces the chances of survival by about 10%, hence early bystander CPR and defibrillation being vital to improve patient outcome for OHCA in for first few minutes before the arrival of EMS.

The chain of survival (Figure 13) ensures that an OHCA victim has the best chances of survival and outcome. Having the right information at each of the chain link is key to the effectiveness of the entire chain. In this paper, we present how digital technologies are used and how data is acquired, maintained, retrieved, and applied to support the chain of survival.

Methods

A feasibility study into a national PAD database was conducted to gather and analyse findings to answer four main questions: (1) what is are the characteristics of an effective PAD programme? (2) What are the facilitators and barriers to PAD use? (3) How can a PAD database contribute to an effective PAD programme? (4) What systems have been used to map PADs and what are their effective and cost? The study included a rapid review of the published and grey literature; consultations with key stakeholders; and international experience from an International Advisory Group.

Results

The first link in the chain of survival is preparedness, the early recognition of cardiac arrest and calling for help. The second link is for early CPR until emergency services arrive. Members of the public can prepare for such events through training and awareness sessions, many of which are conducted by ambulance services in the UK. A number of mobile apps are available for resuscitation training, but most focus on CPR with little coverage of use of a defibrillator4. Preparedness also includes having PADs in locations where OHCA happen. PAD programmes have been set up in many countries to place AEDs so they can be used in cases of OHCA. Different approaches have been used to strategically place AEDs for optimal effectiveness, such as using OHCA incidence data, or use the characteristics of locations, for instance busy areas as airports and train stations, or type of activity, such as gyms or leisure centres. Mathematical models have also been used to strategically place AEDs for optimal geographical coverage while still being within reach of bystanders fetching the AED.

The third chain link is early defibrillation. A number of reasons account for the low use of automated external defibrillators (AEDs). One of them is the lack of information about their location – emergency services can only direct bystanders to a PAD if they know where it is. All 14 ambulance services in the UK have their own register of AEDs and they gather that information in a number of ways, including placing or maintaining the AEDs themselves; encouraging AED owners to report their devices via the manufacturer,
online registration or registration campaigns. There are other groups that also have AED registers who may or may not work with the local ambulance service. The cluttered landscape for AED registration can cause confusion for AED owners and the public. The granularity and quality of information in the registers also vary. Some registers have only information about the location, availability (24/7 or restricted times) and accessibility of AEDs (unlocked or code needed). While others also have information about consumables, such as battery and pads that have expiry dates. New methods of automatically locating and maintaining AEDs are starting to be available, for instance, the use of unique device identifiers, GPS-location, machine-to-machine communication, as well as self-testing and notification capabilities.

There are three main types of apps and systems for mapping AEDs. The first type are for awareness and usually have a map showing the locations of AEDs, e.g. South Central Ambulance Service app. The second type alerts volunteer responders of OHCA events close to where they are located so they can respond. The third type involves the alert and dispatch of volunteer responders by emergency services directly from their computer assisted dispatch (CAD) systems – many systems in the second category have these features, e.g. PulsePoint, GoodSAM, FirstAED, Heartsafe Living. Those two categories of systems keep a database of volunteer responders with their real-time locations and enable them to respond or decline requests to assist.

The fourth link in the chain of survival is post-resuscitation care, usually when the OHCA victim is taken by the ambulance service to hospital for follow-up care. To support this process, clinicians at the hospital need to know as much information as possible about the patient and how an AED was used. In the UK, patient records at the ambulance service are largely separate from the hospital records and handovers are not done using electronic means. Important information also lies within the AED itself and this information is not systematically downloaded. Challenges include the lack of standardization which means that information can be downloaded from devices using USB ports, memory cards, etc. and AED manufacturers have their own software to support the download process. The AED data is useful for clinical care and research, but some AEDs have limited memory and data may be lost if data is not downloaded regularly.

Linking back to preparedness is to prepare and return the used AED to its original location, ready to be used. Informatics plays a role in this step as owners need to be notified that their AEDs have been used and need to have the consumables replaced. Additionally, ambulance services set used AEDs as inactive on their CAD system, until they have been serviced. Increasingly automated solutions to support these processes will ensure the effectiveness of the chain of survival.

Discussion and Conclusion

Public access defibrillators play a vital role in the positive outcomes of OHCA victims, especially when they are used by laypersons before the arrival of emergency services. In this paper, we presented where informatics is used at different points along the chain of survival. The collection, maintenance and retrieval of AED location information is crucial for emergency services to be able to accurately direct lay responders to accessible, available and working AEDs. Advances in automatic alerts to first responders via mobile apps are increasingly involving the community in actively participating in emergency situations when ambulance services would often be too late for an OHCA victim. Increasing the automation for AED maintenance alerts to facilitate the process for AED owners should be considered, especially as an increasing number of PADs are being purchased. Finally, improving the linkage of electronic records between ambulance services and hospitals, as well as other relevant health and care data can help to build a better picture of how OHCA can be better managed and prevented.

Acknowledgement

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Older People’s Motives to Use Falls Prevention Exergames

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Abstract

Which factors influence the motivation of older people at risk of falls, to use falls prevention exergames to improve their physical function and reduce their fall risk? A mixed methods study was conducted in which 12 older people aged 59 till 91 years participated. The results show that the older people are intrinsically and extrinsically motivated which indicates that exergames are a promising tool for fall prevention.

Introduction

The proportion of older people is increasing worldwide.\textsuperscript{1,2} In the UK, the proportion of older people is even higher compared to the average worldwide.\textsuperscript{3} Older people are at increased risk of falls due to factors such as reduced physical strength, balance and the use of certain medications or large numbers of medications.\textsuperscript{4} One in three people aged 65 years and older fall each year in the UK.\textsuperscript{5} The consequences of a fall are various; from a bruise or sprain to a traumatic brain injury or hip fracture. These consequences are related to decreased health and psychological well-being, and increased expenses in the health care sector.\textsuperscript{5,6,7} The consequences of a fall can also cause death, with approximately 3,653 older people dying due to a fall in the UK in 2013.\textsuperscript{3} One of the best modifiable risk factors to reduce the fall risk among older people is physical exercises.\textsuperscript{8,9,10} To improve physical function and reduce fall risk, MIRA Rehab has developed falls prevention exergames with and for older people. Exergames are videogames which combine gameplay with physical exercise. The exergames keep track of the client’s performances e.g. speed, scores and number of games played.\textsuperscript{11} The exercises in the exergames are based on the FaME and Otago exercise programs which are proven to reduce the risk of falling among older people.\textsuperscript{12,13,14} To improve physical function and reduce the risk of falling, older people may be motivated to use the exergames for a longer period of time. Nevertheless, it is unknown if and why older people are motivated to use falls prevention exergames. Therefore, the objective of this study is to investigate which factors influence the motivation of older people, who recover from a fall or who have a high risk of falling, to use falls prevention exergames to improve their physical function and reduce fall risk.

Methods

Twelve older people, aged 59 to 91 years from two supportive housing facilities in North West of the UK, one physiotherapist and one warden participated in the study (see Table 1). The exergames were set up in a communal room in the two supportive housing facilities where the participants live. At one housing facility, the exergames were offered three times a week for 12 weeks and at the other housing facility, three times a week for six weeks. This is a mixed method study in which interviews, Technology Acceptance Model questionnaires and 81 hours of observation of the participants using the exergames were conducted. The interviews were transcribed and concurrently analysed using constant comparative analysis. After open coding, a coding framework was developed. The interviews were coded and analysed in Atlas.ti7 coding program. The questionnaires were analysed in Microsoft Excel 2010.

Table 1. Participant demographics

<table>
<thead>
<tr>
<th>Participant*</th>
<th>Age</th>
<th>Sex</th>
<th>Impairments</th>
<th>Marital status</th>
<th>#sessions/ weeks used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ms Smith</td>
<td>67</td>
<td>Female</td>
<td>Depression with anxiety, Bipolar disorder</td>
<td>Engaged</td>
<td>15/6</td>
</tr>
<tr>
<td>Mr Darcy</td>
<td>89</td>
<td>Male</td>
<td>Depression**</td>
<td>Single/never married</td>
<td>41/12</td>
</tr>
<tr>
<td>Ms Collins</td>
<td>66</td>
<td>Female</td>
<td>Depression**</td>
<td>Divorced</td>
<td>13/6</td>
</tr>
<tr>
<td>Mr Crawford</td>
<td>63</td>
<td>Male</td>
<td>Disability right hand</td>
<td>Single/never married</td>
<td>6/6</td>
</tr>
<tr>
<td>Ms Price</td>
<td>80</td>
<td>Female</td>
<td>Depression with anxiety</td>
<td>Widowed</td>
<td>30/12</td>
</tr>
<tr>
<td>Mr Rushworth</td>
<td>66</td>
<td>Male</td>
<td>Mild cognitive impairment</td>
<td>Single/never married</td>
<td>16/6</td>
</tr>
<tr>
<td>Ms Bertram</td>
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<td>Depression with anxiety</td>
<td>Widowed</td>
<td>13/9</td>
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<tr>
<td>Mr Wickham</td>
<td>60</td>
<td>Male</td>
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<td>Engaged</td>
<td>15/6</td>
</tr>
<tr>
<td>Mr Willoughby</td>
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<td>Male</td>
<td>Depression</td>
<td>Single/never married</td>
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<td>Ms Bennet</td>
<td>81</td>
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<td>Depression</td>
<td>Widowed</td>
<td>3/12</td>
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<tr>
<td>Ms Dashwood</td>
<td>91</td>
<td>Female</td>
<td>Depression</td>
<td>Widowed</td>
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<tr>
<td>Mr Ferrars</td>
<td>59</td>
<td>Male</td>
<td>Depression</td>
<td>Single/never married</td>
<td>2/6</td>
</tr>
</tbody>
</table>

*The names of the participants are changed for anonymity

** According to the DSM-IV criteria for depression and herself, this person suffers from a depression. However, this is not reported in her medical history.

Results
The findings of this study show that the participants are intrinsically and extrinsically motivated. They are intrinsically motivated because they enjoy playing the exergames and the use of the exergames appears to increase their physical, mental and social confidence. In addition, the social interaction which was provided in this study was an important extrinsic motivator which increased the intrinsic motivation to adhere to the falls prevention exergames. The participants are extrinsically motivated mainly because they have certain goals or outcomes which are important for them to reach: improving their physical function; improving their scores; and keeping their memory active. Also, it appears that the participants have a fear of ageing and the consequences of ageing. Fear is an intrinsic feeling caused by an extrinsic factor, which is ageing and the related consequences of ageing.

Discussion
The use of mixed methods increases the validity of the findings. The interviews, questionnaires and 81 hours of observations in general agree on the findings. Nevertheless, a limitation of this study is that not all 19 older people who undertook the exergames program participated in this study. Seven older people decline to participate in this study because of reasons such as not in the mood for an interview, having many appointments at hospital or being in hospital. This might indicate some selection bias in this study. This selection bias might indicate overestimation of the motivation of older people towards exergames because most of the participants in this study adhered to the exergames for a longer period of time.

Conclusion
Falls prevention exergames are a promising tool for fall prevention because the findings of this study show that older people can be intrinsically and extrinsically motivated to use the exergames for a longer period of time.

Recommendations
The social setting appeared to be an important factor for the intrinsic motivation of enjoyment. Therefore it is recommended to incorporate social interaction with the exergames, for example during coffee breaks in a lounge of an extra care housing facility.

References
The Digital 'Red Book' - Digital Transformation of the 0-5 Year Pathway

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Abstract

The paper ‘Red Book’ recording a child’s health and development from ages 0-5, is unique as a citizen-owned record that follows a child through health, care and education. Engaging citizens in the health of their children and flowing data between these different services and organisations in different locations. We will share the lessons that can be learned from the eRedbook pilot sites, the digital advantages that can be established and the current progress scaling adoption.

Introduction

- eRedbook is the digital version of the Personal Child Health Record (‘Red Book’).
- As a citizen-held digital health record, it allows whole new levels of data sharing and collaboration between citizens and their health professionals.
- eRedbook has been in development since 2013 as a collaborative project between NHS, technical partners and the Royal College of Paediatrics and Child Health (RCPCH). It is clinically validated and endorsed by the RCPCH and Community Practitioners and Health Visitors Association (CPHVA).
- eRedbook supports the Health Child programme, capturing all screening results, immunisations and health checks on the 0-5 pathway. A large-scale field test with parents and health professionals in London will take place from 2016.

The Personal Child Health Record (PCHR), informally known as ‘Red Book’, has been in existence for over 20 years. It is the national standard health and development record given to parents/carers at a child’s birth and contains information including a child’s screening results, all immunisations for children 0-5 years, upcoming health appointments, height and growth charts.

Unlike most medical records, it’s the parent or carer who is the owner of the data in the red book: health professionals update the record each time the child is seen in a healthcare setting and copy information provided in clinical systems, facilitating a complete record of a child’s health. The standards and content of the red book are reviewed by a multidisciplinary group led by the Royal College of Paediatrics and Child Health (RCPCH). In an increasingly digital world it’s not surprising that people are expecting the NHS to ‘keep up with the times’ and offer better access through digital services. Recent figures from research carried out by Deloitte show that 76% of all people in the UK own a smartphone – looking at just the under 24s, that number is even higher with 90% of them using their smartphone to access the internet.

Methods

In 2013 a three-year innovation programme named ‘dallas’ (delivering assisted living lifestyles at scale) was funded by Innovate UK (then known as the Technology Strategy Board) to consider how new ideas and technology could be used to improve the way people live, beyond a traditional health and social setting. One of the projects that was part of the dallas programme was ‘Year Zero’, which was aimed at enabling citizens to take an active part in managing their own health, using personal health records to share information with health professionals.

As the red book is a prime example of a personal health record that is used to facilitate communication between citizens (in this case, parents) and health professionals, a project was initiated to create a digital version as part of ‘Year Zero,’. Partners in the project were Harlow Printing (publisher of the paper red book), Sitekit (software developer), the Royal College of Paediatrics and Child Health (professional body) and Microsoft (platform provider).

The digital red book, which received the name ‘eRedbook’ was developed in collaboration with Liverpool Community Health NHS Trust. The project team used a co-design approach to designing the eRedbook, making sure that health professionals and parents had a direct say in how the product was being designed and provide on-going feedback on the development of the product through frequent focus groups and workshops. The eRedbook uses Microsoft HealthVault, an online health platform, to store a child’s data. The eRedbook acts as a layer on top of the HealthVault service and as such no data is actually stored within the eRedbook itself.

Microsoft HealthVault is hosted on secure data servers within the EU. Parents will need to ensure that they use a password that’s not easy to guess, and not give out the password to others, to minimise the risk of others accessing the record. Confidentiality is important, parents and health professionals should be encouraged to routinely change passwords and have up-to-date anti-virus software on their computers and other devices.

It is important to note that the eRedbook is not meant to replace the paper red book or the primary medical record. Instead, it’s a secondary copy of a medical record which provides parents with a choice of how they wish to interact with health services. Some parents will prefer the paper version, while others will opt for the digital version – either way, by giving people the choice, it’s more likely that they will find the red book engaging, accessible and easy to keep up-to-date.
Results

The eRedbook is now established, clinically assured and endorsed by the RCPCH1 by the Community Practitioners and Health Visitors Association.6 A ‘paperless NHS at the point of care’ is one of the key objectives of NHS England’s digital strategy,7 a target which is set to be achieved by 2020. The eRedbook is one of the exemplars of that digital strategy and has been referenced in national policies and strategies, including ‘Personalised Health and Care’ by the National Information Board8, which specifically mentions “the move to digitise the ‘red book’ given to all new mothers in which to record their baby’s information” as one of the aims. Discussing ‘Personalised Health and Care’, Tim Kelsey, National Director for Patients and Information, said: “New mothers will now be able to carry their red book around with them on their smart phone and tablet as the NHS moves towards offering digital Personal Child Health Records. This will put an end to worrying about leaving your child’s information at home when going for a review, vaccination, or emergency treatment.”9

Endorsement was also received from Lord Ara Darzi of Imperial College London, who said: “Only patients can unlock the potential of electronic record. The Sowerby Commission suggested last June, and the NIB has now confirmed, that a digital “Redbook” – a child’s health record for parents – is a great place to start”.10

Work is underway to field test and provide eRedbook to parents in London for 135,000 births in the capital every year. During December 2015 seven NHS Trusts in London were working at pace as early adopters, all keen to be the first to go live in London. The initial Trusts in London will be field testing to inform a wider roll-out which will continue in 2017 and 2018, including all 32 boroughs and clinical commissioning groups in the London region.11 Parents in London will be offered the choice between the paper red book and the eRedbook. For health professionals, this means that they need to make parents aware of the existence of the digital alternative and familiarise themselves with the digital interface. Roll-out of the field test will therefore be accompanied with training & support for all healthcare professionals involved. Trusts enthusiasm are keen deploy eRedbook, NHS England and Sitekit are currently in the process of getting Trusts started, all eyes are currently on which trust will be first.

Discussion

In addition, recent official CHIS (Child Health Information Systems) and information requirements specification, published by Public Health England, state that all systems “must integrate with an electronic health record (e.g. Personal Child Health Record, eRedbook and GP systems), which all parties, (including parents and adolescents) would collaborate to maintain.”12 Keeping this requirement in mind, it’s no question if the eRedbook will be introduced at NHS Trusts, but rather how soon.

Conclusion

There are many benefits to the eRedbook, from ‘it makes sense to the digital generation’ to the potential of massive time savings for health professionals and cost savings for the NHS as a whole. With national support for the eRedbook at policy and strategic level and backing from senior NHS figures such as Jeremy Hunt, Simon Stevens, Tim Kelsey and Lord Ara Darzi the road is clear to start offering the eRedbook to parents in the UK. A large-scale field test set to commence in London in 2016 will help pave the way for other Trusts UK-wide to implement the citizen-held eRedbook. The successful London deployment of eRedbook will be a milestone step towards revolutionising the way citizens and health professionals collaborate and communicate, with untethered, personal health records becoming the norm, enabling individuals to have ready access to a personal copy of their health and lifestyle information and also for those they care for – whether young child or elder parent or other carer.

References

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Using Data from Low-cost, Off-the-shelf Devices to Monitor Exercise Adherence in Respiratory Patients, During Their Pulmonary Rehabilitation Programme

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Abstract
Monitoring of physical activity can provide important data throughout pulmonary rehabilitation. This study aims to evaluate the feasibility of monitoring physical activity of respiratory patients through usage of low cost, off-the-shelf devices. This will include a wrist-worn pulse oximeter and a wrist-worn accelerometer, tested on both healthy subjects and patients performing a set of exercises from a pulmonary rehabilitation programme. The data coming out from this sensor integration are processed to extract useful information on movement intensity and quantity, to help improve quality of the rehabilitation programme.

Introduction
A pulmonary rehabilitation programme consists of a set of physical exercises tailored for respiratory patients, with an aim to improve cardiovascular fitness over a period of several weeks. Currently, the evaluation of patients’ progress is carried out only in a qualitative way, through supervision by physiotherapists and the use of questionnaires. A quantitative description of patients’ physical activity, especially in a home environment, can guide physiotherapists and physicians through an improved provision of a rehabilitation programme. From literature, the possibility of quantifying physical activity can be achieved by usage of motion sensors, such as triaxial accelerometers⁴,⁵ with intensity indexes (VMU, Vector Magnitude Units, which integrates the 3-axis accelerations in the way shown in Methods section).³,⁵ Furthermore, these devices can be used for counting repetitions of several tasks.⁴ Nevertheless, there is limited evidence regarding the use of combined pulse-oximetry and accelerometer data for monitoring physical activity,⁶ particularly in pulmonary rehabilitation programmes. The aim of this study was to investigate two low cost, off-the-shelf devices inclusive of a pulse-oximeter and an accelerometer to provide quantitative and multi-parametric assessment of patients’ physical activity.

Methods
This study evaluated motion during three commonly used pulmonary rehabilitation exercises, to address whether effort made by the end-user can be determined.

Three non-invasive wearable devices, were used to acquire the data: a wrist pulse oximeter (Prince 110H/PC 68B), a wrist accelerometer (Texas Instruments ez430 Chronos) and a waist worn inertial measurement unit (BTS G-Walk) used for comparison with the wrist accelerometer data. The accelerometer provided the acceleration amplitude of the arm in three dimensions, while the IMU (inertial measurement unit) supplied the angular rate and the acceleration amplitude of the waist in the three directions. Furthermore the pulse oximeter provides SpO2 (oxygen blood saturation) and heart rate signals. Healthy volunteers and respiratory patients in pulmonary rehabilitation classes were tested. The exercise protocol was designed in collaboration with a physician and physiotherapist. The acquisition protocol required 20 minutes for each session. At the beginning of each experiment, a balance sensor (i-Balance) was used to gather some physiological data from the subject (weight, body fat, lean mass, muscle mass, bone mass, body water, body mass index (BMI), Daily Calorie Intake). Next, participants were asked to carry out three different physical exercises, in increasing intensity, with a resting period in between, as follows:

- 30 seconds of baseline reading: assessment of the baseline SpO2 (Oxygen Saturation) and Heart Rate
- 3 minutes of ‘Ball Raise’ exercise
- 3 minutes of Resting
- 5 minutes of ‘Marching’ exercise
- 3 minutes of Resting
- 2 minutes of ‘Step Ups’ exercise
- 5 minutes of resting

During the resting period, the perceived breathlessness of the patient was assessed using the Borg breathlessness scale. Movement signals from the accelerometers were filtered and aligned in Matlab in order to find reliable features and indexes for quantifying physical activity in terms of intensity and amount (also following the indication of the literature (e.g. exercise repetitions (4) and
VMU (1,2)). In particular, the calculus of the VMU consists of the square root of the sum of the squared filtered signals from each accelerometer axis (x, y, z):

$$VMU = \sqrt{acc_x^2 + acc_y^2 + acc_z^2}$$

In addition, signals from the wrist-oximeter, in combination with the accelerometers signals, were used to find, if existing, a model capable to explain the tasks performed by the participant in a multi-parametric way. Lastly, an explorative data analysis was conducted using the two samples, to understand if any clustering could be made; taking into account the physiological data collected from the i-Balance device.

**Results**

The study is currently underway. The data acquisition is due to start and preliminary results can be shown at the WIN conference in January.

**Discussion**

The explorative statistical analysis conducted on the integrated signals, from the accelerometer and the pulse-oximeter, allow for comparison of oxygen saturation and movement intensity measurements during the execution of exercises. Once results are generated it will be possible to infer the effectiveness of these particular low cost devices to monitor physical activity in healthcare, particularly in a pulmonary rehabilitation programme. In addition, the findings could be further used to assess how such devices could be embedded in a single device and interfaced with a tablet application. This means that a way to provide simple and understandable information from the app should be investigated, in order to properly tailor a service to monitor the rehabilitation in a quantitative and multi-parametric way, and motivate the patient in carrying out as much physical activity as possible.

**References**

Facilitating Ecological Momentary Assessment through Visual Programming

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Abstract

Ecological Momentary Assessment (EMA) methods capture patients’ symptoms and feelings in real-time, in their everyday environments, allowing for regular contact and continuous monitoring between patient and clinician. Today, the proliferation of mobile technologies afford healthcare professionals opportunities to reach patients in varying contexts, but implementing such applications requires software developers, or expensive commercial tools. This presentation demonstrates our application to allow health professionals with no programming experience to develop their own EMA mobile apps.

Introduction

Ecological Momentary Assessment (EMA) is a set of methods used by researchers and health professionals in the domains of psychology and medicine¹. Via EMA, participants provide data ‘in-situ’, as they go about their everyday lives. This data could take the form of physical attributes and symptoms, or emotional attributes such as thoughts and feelings currently being experienced. It can be used both in research studies, and in real-world clinical settings for constant patient monitoring.

EMA minimises ‘recall bias’ where patients are otherwise required to recall their experiences at a previous time, which could be easily forgotten. Additionally, it allows for more frequent and long-term monitoring of patient attributes. In modern-day EMA studies, patients can provide information through their own mobile devices, possibly multiple times a day over a course of weeks or months². This is a far more patient-centric approach to care, as long-term conditions can be more directly managed without requiring a patient to constantly return to a clinic, reducing the burden on both sides.

Methods

Previously, the gold standard for obtaining ‘in-the-moment’ feedback was the use of pen-and-paper diaries. These are cumbersome and do not allow for continuous collaboration between patient and clinician. In order to make care more patient-centric, more direct communication is required, which we envisioned could be achieved through the triggered delivery of surveys on a patient’s mobile device. These would be completed on the device itself, and the results instantly available to a clinician for analysis. Real-time patient answers and compliance could be used to tailor an application to an individual’s needs.

We have implemented ‘Jeeves’, a desktop environment that can be used to generate EMA study specifications by end-users with no prior programming experience. The specifications are converted to files that are interpreted by an Android smartphone app, through which surveys are directly delivered at appropriate moments. The primary requirement for Jeeves is that it should be usable by health professionals with minimal training and education.

We designed our environment’s constructs and components by reviewing recent studies in the medical and psychology literature. By doing so, we were able to gain a stronger understanding of the requirements of such studies, so that Jeeves can be used to theoretically replicate many study specifications that were programmed from scratch or with an expensive commercial tool.

Jeeves is a visual programming environment, whereby EMA configurations are composed by dragging and dropping graphical “blocks”. These connect like jigsaw puzzle pieces, where only correct pieces can fit together, eliminating syntactical errors associated with textual programming. Fig.1 demonstrates part of such a configuration. This particular configuration triggers when a patient receives an SMS. It will wait for 5 minutes, then send the user the “SMS Survey” to complete, along with an audible alarm. Until the user completes the survey, it will repeat this at 5-minute intervals. Triggers can be interval, signal or event-contingent³ where events can be detected by Android smartphone sensors.

As these surveys are a key component of EMA, Jeeves includes a built-in survey editor. Through this, questions can be created of different types (including open-ended, multiple choice, and Likert scale options), also supporting conditional logic such that certain questions are only prompted by specific answers to previous questions. Fig. 2 shows a screenshot of the creation of the ‘SMS survey’, where a multiple choice question is conditionally followed by a Likert scale question. It is also possible to store the answers to particular questions as ‘variables’, so that specifications can be tailored to an individual’s responses.

Fig 1: Example blocks in Jeeves for sending the ‘SMS survey’

Fig 2: Segment of the survey creation form for editing the questions sent to patients

Results

To assess the usability of *Jeeves*, we took quantitative and qualitative measures from a user study with 20 student participants from our university. 11 had some programming experience, ranging from complete novice to expert, and 9 had none whatsoever.

The study itself consisted of four tasks: 1. A step-by-step guide through the creation of a basic configuration; 2. Testing the readability and comprehensibility of a pre-built configuration; 3. Testing participants’ ability to modify this configuration with additional functionality; 4. Testing participants’ ability to build a configuration from the ground-up, based on an English-language specification.

Our quantitative results compared programmers and non-programmers on how usable they found the environment in completing the above tasks. We found no significant difference in usability scores from programmers and non-programmers, which were 71.8 (SD=10.7) and 67.2 (SD=13.9) respectively, as measured by the System Usability Scale. Given that a score of 70 indicates a good standard of usability, this is a promising result. In our qualitative analysis, we coded end-of-study participant feedback into categories, and the frequency of positive/negative comments in each (see Fig. 3 for results).

Discussion

From the qualitative and quantitative results we obtained, it is clear that our application is usable by participants from a variety of study backgrounds and programming experiences. Categorisation of participant comments, particularly those by non-programmers, highlighted the learnability of the application – a promising result that provides us with confidence that *Jeeves* would lower the barriers to healthcare app development by non-programming clinicians, increasing the prevalence and associated benefits of such applications. Positive results for likeability and visual appeal also provide support for our block-based programming paradigm.

Limitations - We acknowledge that such results do not generalise to real-world use, where we would need to conduct such studies with clinicians who have a professional interest in using our environment. However, we treated this study as a feasibility analysis of *Jeeves* as a concept for use by programming novices. It was considered to be of primary importance to confirm that participants of varying programming experience could use *Jeeves* before testing with our target demographic, who are more difficult to recruit.

Future work - A future phase in our research, following a second iteration of the visual language’s design cycle based on feedback, is to refine our Android application to allow robust EMA protocols to be run and tested in real-world situations. To ensure that our application is relevant, we are currently engaging with a number of healthcare professionals in order to elicit requirements that they may have for engaging with their patients through mobile devices. From an initial discussion with a local medical researcher, the issue of managing ‘multimorbidity’ has been brought to our attention. Challenges include the fragmentation of care knowledge across multiple doctors, as well as enabling patient-centric care where the burden of multiple different treatments is compounded by patient characteristics such as poor memory, lack of social support, or low motivation.

We plan to study how *Jeeves* could be used as a means of cooperation between a patient and their various associated healthcare professionals, supporting the idea of “holistic” patient care. The intuitiveness of the visual language means that it could be used by a clinician to visually describe and adjust a proposed protocol with their patient. By using *Jeeves* as a shared source of understanding, patients could take a more direct role in managing their own conditions through collaboration with their clinician.

Conclusion

We have described *Jeeves*, a visual language and environment for the specification of Ecological Momentary Assessment applications for Android smartphones. We have attempted to ensure its real-world applicability by recreating EMA study protocols from the literature, and conducted a usability study, in which we showed that the environment can be feasibly used by participants with no programming experience.

It is our belief that this technology will facilitate patient-centred care, through personalisation of configurations to an individual’s needs, constant feedback and collaboration between patient and clinician, and the possibility of additional collaboration between multiple healthcare professionals to consider an individual patient’s needs as a whole.

References

A Proof of Concept Trial to Deliver a Digital and Physical Rehabilitation Model to Patients with Back Pain

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Abstract

This proof of concept trial challenges the traditional management of back pain by lone physical interventions. This trial indicates a digital and physical treatment approach to back pain can increase patient engagement, provide appropriate early intervention and increase resilience and self-management in order to decrease the risk of chronicity to the sufferer.

Introduction

Spring Active HealthyBack Coach™ service is a digital and physical “virtual” service for the treatment of back pain, which combines digital screening, HealthyBack™ eBook and remote video consultations with a Chartered Physiotherapist.¹ This service is offered in comparison to face to face physiotherapy offering traditional physical interventions for the management of back pain. With this clinical service remote treatment replaces the delivery of face-to-face treatment completely or partially.

This solution aims to:

- Deliver significant cost saving
- Be a fast effective treatment solution
- Promote active self-management by the patient
- Be arranged at the convenience of the patient
- Establish ‘virtual’ patient and clinician relationship

Methods

In July 2015 Spring Active conducted a proof of concept trial of the HealthyBack Coach™ service with a major U.K. insurer involving two of their clients.

HealthyBack Coach™ Service Description

Clinical initial assessment is by a ‘virtual’ call conducted by a chartered physiotherapist to:

- Clinically establish injury/condition details
- Establish basic activities of daily living
- Apply the International Consortium for Health Outcomes Measurement (ICHOM) Patient Related Outcome Measures for low back pain; EQ5D, Oswestry Disability Index (ODI) and Numeric Pain Rating Scale (NPRS)
- Apply the STarTBack Screening Tool²
- Semi-objectively assess posture, functional testing, certain special tests, active range of movement, pain behaviour and locate exact site of pain
- The patient is directed to sections of the HealthyBack™ eBook for self-management individualized guidance.³⁹
- Make a clinical recommendation for treatment which can be a clinical remote ‘virtual’ management treatment
- Arrange referral for appropriate face to face treatment

Clinical follow up calls provide motivation, advice and progress patients’ recovery. This support also replaces the need for further Referral Management as the Spring Active clinician will be managing the treatment provided to the patient and ensuring that the treatment amount is relevant and clinically appropriate to the patient’s recovery. It includes:

- Up to 3 clinical follow up ‘virtual’ calls over a course of 3 weeks
- End to end referral management
- Spring Active contacted the 2 participants within 24 hrs of receipt of referral and arranged an Assessment Call & 2 support calls within 4 days of referral.
- Spring Active sent out the Customer Satisfaction Survey to the participant within 2 days of programme completion.
- Spring Active sent out the Discharge Summary Report to the participant within 2 days of programme completion.
Results
Following the trial all HealthyBack Coach participants were asked to complete a Customer Satisfaction Survey following treatment. The results showed the clients were satisfied with the service, thought it was reliable and of a high quality, met their needs, was responsive and was helpful in managing pain.

The participants of the HealthyBack Coach™ service were asked via email to complete the chosen PROMs, in accordance with ICHOM, via registration at MyClinicalOutcomes.com. Neither participants of the trial completed the registration process. Following this it was recognised that collecting PROMs in this way may be problematic and a review has been undertaken.

Discussion
This trial indicates a digital-physical treatment approach to back pain can increase patient engagement, provide appropriate early intervention and increase resilience and self-management in order to decrease the risk of chronicity to the sufferer. Challenges highlighted included how to capture patient outcomes digitally.

Conclusion
The participants of the trial reported the following benefits:

- Reduced pain on NPRS
- Increased functional improvements
- Increased self-confidence and efficiency managing back pain in the workplace
- Remained in work throughout programme

Spring Active has shown the Proof of Concept is valid and at present in engaged in a much larger trial to refine the process of the HealthyBack Coach™ offering and establish the range of clinical outcomes possible from the intervention.

References
Adherence: Time for a new definition?

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Abstract

In this conceptual paper we derive a new definition of adherence by assessing definitions of patient adherence, behavior and consumption theories, and evidence from field experiments and modelling recorded in over thirty papers covering 40 years of research. This definition takes patient centricity as its starting point. If this definition were to be adopted it would have implications on the practitioner-patient relationship and on pharmaceutical manufacturers; these are also considered.

Introduction

Musgrove says of clinical services, “At the centre of service delivery is the patient”\(^1\). Yet when we consider adherence, the message is that patients must follow the instructions that they have been given. Is this a reason for patients not achieving higher adherence rates than the 50% or so commonly reported?\(^2\)–4.

A low rate of adherence is blamed on the patient. Firlik said, “What we need are new ways to improve human motivation to take the medications... The holy grail here is to add motivation innovation to the mix, to reach the under-motivated folks who represent the most serious risk to poor outcomes”\(^5\). While this may be true in some circumstances, he overlooks the possibility that some patients, however motivated, are unable to take their drugs due to an ever-changing combination of their context, their constraints, a lack of agency, and a lack of resources. In addition, 100% adherence may not even be necessary for a medicine to be effective. What do these things mean for a definition of adherence?

This paper therefore starts by looking at existing definitions of adherence. It then moves on to consider consumption theories and the light they can shed on adherence, before presenting field research on issues preventing adherence. It also analyses the currently limited research on what levels of adherence are necessary for efficacy. Combining these things together permits us to propose a new, qualitative and patient-focused definition of adherence which takes account of reality. Finally, the implications of this definition on the practitioner-patient relationship and on pharmaceutical manufacturers are considered.

Methods

A review of adherence literature, both academic and grey, was performed to build a set of adherence definitions. The Ascertaining Barriers for Compliance (ABC) project’s 2012 report\(^6\) was used as a basis for this, plus convenience sampling of definitions from over 20 further practice-based and theoretical papers.

In addition, theories of consumption and behaviour were reviewed in order to position adherence within consumption them. In particular, Hull’s Theory of Behaviour\(^7\), Ripple’s COM-B model\(^8\), Consumer Culture Theory\(^9\), Theory of Reasoned Action\(^10\), Theory of Planned Behaviour\(^11\), and the Unified Model of Task-Specific Behaviour\(^12\). In addition, Bahl & Milne’s Dialogical Self Model\(^13\) and Service-Dominant Logic’s concepts of value co-creation and Service Ecosystems\(^14\) were considered.

Papers investigating the level of adherence for efficacy were analysed to understand the adherence actually required of patients.

Semi-structured interviews were held with 30 people (convenience and snowball sampling), most of whom were resident in sub-Saharan Africa, in order to obtain first-hand information about both factors preventing adherence and attitudes towards adherence.

A list of factors was obtained and comparisons performed with adherence literature including the World Health Organisation’s “Adherence to Long-Term Therapies”\(^1\) and Salmane-Kulikovska & Dobelniece’s 2012 meta-analysis\(^15\). The lens of Service-Dominant Logic was used as a structure within which to analyse all inputs.

Results

Almost as many definitions of adherence exist as there were papers which offered a definition. They range from the highly detailed proposal from the ABC project to the overly simple “correct behaviour”\(^16\). Many papers, particularly those reporting adherence interventions, did not even specify a definition of adherence for their research. Van Dulmen et al.\(^17\) in their “review of reviews” highlighted the issue that these differences in definitions and how they are operationalization make it hard if not impossible to compare achievements in reported interventions.

A threshold of 80% is traditionally considered to be acceptable\(^18\), although this is acknowledged to be theoretically unsupported. This figure masks the varying ways in which adherence may not be 100%: regular but infrequent lapses, rare but lengthy gaps, etc.

The 30 interviews revealed a wide range of factors causing non-adherence, from packaging design to taste and size of tablets.

These inputs were used to derive a new definition for adherence. This definition takes account of the complexity of consumption contexts and the need to recognise who is ultimately responsible for deciding whether to be adherent and why: the patient. The new definition is qualitative rather than quantitative, and patient-focused rather than practitioner-driven:
Adherence is using skills and resources to follow an externally imposed pattern of behaviour sufficiently to achieve the patient’s objectives in context.

Discussion

This definition of adherence places responsibility for deciding on the level of adherence firmly with the patient. This will depend on consumption contexts taking account of all factors including treatment benefits, contra-indications and patient self-perceptions of the relevant service ecosystem including self, family, colleagues, church congregation, community, health supply chain.

If pharmaceutical industry wishes to see increased adherence, then this definition places the onus on them to improve their understanding of patient consumption contexts. As Friend et al. said “[Pharmaceutical manufacturers must] acquire a much deeper understanding of patients in a world where outcomes count for everything”19. All causes of non-adherence must be assessed, not as justifications to blame the patient but as opportunities to make consumption easier. In part at least, this is because – as Novartis CEO Joseph Jimenez said in 2013 – pharmaceutical manufacturers “are going to be paid on patient outcomes as opposed to selling the pill”20. In addition, it highlights the vital importance of communication by practitioners and manufacturers, both in the surgery and on medicine packaging.

Conclusion

This paper proposes a new definition of adherence based on a new analysis of literature plus research in resource-poor environments. It then explains the implications of this definition focusing on the relative responsibilities of patients, practitioners and pharmaceutical manufacturers.

References

The Implementation of STarT BACK and an OA e-template: Utilising Existing GP Electronic Clinical Systems to Manage Patients with Low Back Pain or Osteoarthritis during a Routine Consultation

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Abstract
The aim of these electronic template innovations is to remove barriers to implementation of clinical guidelines and assist clinicians in their consultations with patients with low back pain and or osteoarthritis. Utilising existing GP clinical systems it is possible to embed computerised templates, auto populated referral letters and embedded bespoke patient information to assist clinicians’ management of these conditions and enhance, not hinder, the consultation process.

Introduction
STarT BACK Screening Tool
Patients with non-serious low back pain managed with a stratified care approach (screening tool plus matched treatments) have improved clinical outcome and is cost effective (Hill et al, 2011 ¹). The STarT Back screening tool is a 9 item questionnaire that identifies patient’s risk (low, medium or high) of developing persistent disabling back pain. Matched treatments are then provided according to need: GP advice, analgesia and supported self-management for low risk patients, traditional (manual) physiotherapy for medium risk patients and psychologically informed physiotherapy for high risk patients. However, this stratified approach is not being consistently embedded into practice.

OA e-Template
Implementation of national (and international) guidance is often patchy with primary care management of osteoarthritis (OA) not being consistent with NICE guidance. The use of structured computerised forms (templates) in consultation improves some aspects of clinical care including adherence to some processes of care GPs and practice nurses are used to such templates as part of their routine consultation recording (Edwards et al 2014 ²)

For the two case examples above, we have designed, implemented and installed a new electronic template to guide and assist in the management of patients within primary care.

Methods
STarT BACK Screening Tool
In the initial phase, practices were identified by a local clinical Commissioning Group (CCG) as part of a West Midlands Academic Health Science Network (AHSN) funded innovation. A dedicated implementation team worked with GPs to design and test an IT solution which embedded the screening tool for stratified care into the GP electronic system. The CCG identified Quality Indicators that could monitor activity along the care pathway, and could sustain and promote professional and system level change. Use of the STarT Back tool, checking for red flags and appropriate referral on to physiotherapy will be measured. Small practice group meetings with GPs, practice nurses and practice managers were used to discuss the original evidence and to refine the screening tool into an IT based solution that could be easily incorporated into routine GP consultations. This solution has now been implemented and is live in 17 practices in the North Staffordshire and Stoke CCG’s and we are working with North West Coast AHSN and CCG’s in Birmingham Cross City, Hereford and South East Staffs and Seisdon and their associated Commissioning Support Units for Staffordshire and Lancashire and North of England to help implement the template.

OA e-Template
The template is triggered by a wide range of OA and joint pain codes which were considered by a panel of 6 GPs to represent possible underlying OA. This template captures aspects of assessment and care not uniformly well-captured by the standard electronic record, including:

- Pain and function assessments
- NICE guideline core interventions of information provision, exercise advice, and weight loss advice
- Physiotherapy use
- First-line analgesic use—paracetamol and topical non-steroidal anti-inflammatories (NSAIDs)
The implementation team are now working with Shropshire CCG to install and embed the template within GP practices in their area. In November 2015, the OA template was endorsed by NICE as part of a suite of tools to support the implementation of the OA NICE Guidance 2014.

**Results**

Both of these clinical tools are currently available within one of the existing clinical systems in primary care (EMIS) in the first instance, with work on going to embed the STarT BACK tool within TPP SystmOne and INPS Vision systems.

**STarT BACK Screening Tool**

A dedicated protocol and e-template has been co-created and embedded within EMIS to support GPs during consultations for low back pain. This includes an auto-calculated STarT Back score and a link to printable, bespoke patient information housed on patient.info. ‘Pop up’ advice for the GP is embedded dependent on the level of risk identified i.e. if low risk to be managed by GP, if medium risk refer to physiotherapy and if high risk refer onto physiotherapists with additional training. An electronic referral to physiotherapy services is automatically populated and generated if required, ensuring that evidence based pathways are readily accessible during the consultation.

The e-template was installed in 17 practices during the period January to November 2015.

During this period, January to November 2015:

- 866 patients consulted with back pain during this period and subsequently activated the e-template
- Of these patients, the tool was used on 190 patients (22%) with STarTBACK tool scores and/or risk factor recorded in the patient’s medical record. Completion of this data was dependent on the version of the tool at the time, the latest version allowed both scores and risk factor to be recorded automatically.
- 97 patients were referred to physio as a result of the tool’s usage.
- 24 patients were provided with a copy of the STarTBACK specific patient information leaflet located on the Patient.info website.
- 17 patients were provided with a further information leaflet that provided website links to the Patient.info dedicated STarTBACK back pain pages and leaflet.

**OA e-Template**

The original template was installed and used in 8 GP practices². Evaluation of the template was positive. Approximately two-thirds of patients with OA or joint pain had at least one template entry completed. However, there was substantial variation between clinicians. A quarter completed at least one entry for 9 out of 10 patients but another quarter did not record any entry for more than half of their patients. Introduction of the template was associated with a significant increase in:

- Weight recording
- Prescription of NICE-approved first line analgesia e.g. topical NSAIDS²

Shropshire CCG have installed the OA e-template in their practices as part of a local enhanced service for OA, and their review of the orthopaedic pathway, which includes training of primary care practitioners in OA self-management strategies and high quality patient information (the OA Guidebook).

**Conclusion**

Stratified care for back pain is clinically and cost effective. Embedding a template within GPs’ existing clinical software ensures that research evidence can be implemented, and an easily accessible solution for a clinician to use the STarT Back tool in routine consultations.

Utilisation of a stratified approach helps to keep physiotherapy waiting lists low and embedding an auto-populated physiotherapy referral form within clinical systems makes it easier for GP’s to follow evidence based care pathways in a busy clinical environment.

OA care has been highlighted as in need of improvement. Non-pharmacological interventions still need to be better-promoted. However, templates can assist with information capture (and audit) and processes of care and are a feasible method of integrating guidelines into routine working patterns. Better care for OA in general practice is achievable given appropriate multidisciplinary support. Non-pharmacological core treatments of education, exercise, and weight loss may require additional resources.

**References**


Open Source Integration

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Abstract

Integration – the exchange of data between systems

- Often it’s down to an implementation of middleware to reach a common ground on payload standards, transmission methods and business transactional units
- Our core integration middleware pattern has the capability to solve many enterprise messaging tasks, based on open source technologies
- Answer Digital has been using these technologies for years in other sectors and deployed the ‘first of type’ NHS open source integration engine in collaboration with King’s College Hospital NHS Foundation Trust in 2014.

Introduction

There is a step shift happening in technical circles within the NHS, locally and nationally. It’s a slow but purposeful move towards community ownership, NHS-held intellectual property, and it has open source and open standards at its heart. In our opinion, this shift is being most successfully pioneered in tackling the ubiquitous need for integration, interoperability and interfaces in the NHS. A gold standard for open source integration is forming, and Answer Digital Health are leading the charge with the Trusts and suppliers we’re collaborating with.

Methods

Traditionally, integration has been solved across the NHS by paying a license fee for a platform, then using skills in house or through a third party to build ‘interfaces’ based on a proprietary tool set. A Trust pays a license for the tool set, and this generally accounts for a majority of the cost of deployment. Intellectual property is locked into the vendor’s product.

With open source, things are different. A pioneer must first invest significantly in building the core of the solution or product, both to meet their own needs, but also in technology and patterns that are usable in a wider context. In 2013, this is exactly what King’s College NHS Foundation Trust set out to do, with seed funding from the NHS Technology Fund.

In 2013 NHS England established an Open Source Programme to encourage the uptake of Open Source Software in Health and Care through education and opportunity for Technology Fund investment to both realise the perceived benefits and also to comply with the Government Digital Service Digital by Default Service Standard to make all new source code open and reusable, and publish it under appropriate licences (or provide a convincing explanation as to why this cannot be done for specific subsets of the source code).

The Open Source Programme is about making best practice IT solutions in health and care accessible to all. By making the software, or the source code freely available and downloadable from platforms such as GitHub, open source software can be developed, improved or tailored to suit the local needs of an organisation. This flexibility makes open source software particularly suitable for use within the healthcare industry where, through active collaboration between IT suppliers and user/clinicians communities, solutions can be honed to maximise benefits to delivery of health and social care. As an outcome of the NHS England programme it supported the establishment of the Open Source Software Foundation for Health and Social Care Community Interest Company in January 2015, renamed the Apperta Foundation in November 2015; founded by leading clinicians to act as a centre of excellence, custodian of the Open Source movement and attract funding for open source projects within health and social care. NHS England’s direct support towards Open Source continues today through the Code4Health programme.
Results

Professional services were sought to build and configure the new open platform. An NHS-owned platform, based on Java technology, deploying Red Hat and Apache Foundation open source components and building a repeatable solution, shareable and accessible. 18 months later, with over one million messages per week traversing the proven production integration engine and it’s 50 connected systems, others have begun to realise the potential in open source middle-ware.

Discussion

The potential savings for the NHS are significant. A large chunk of license fee cost is released in the open source model, and based on an incrementally easier build phase as more Trusts take on the platform (estimating ⅔ less development and configuration required after first-of-type deployment, reaching ⅔ less resource as the service fully matures), the professional services and maintenance costs required to build the NHS-owned platform overall could be up to 75% cheaper for the NHS than the traditional ‘each for their own’ buying off the shelf approach for integration.

In addition, support and maintenance of the platform is shared out equally amongst the community resulting in further savings. Most importantly of all, any future product enhancements for the shared platform put forward by any of the community contributors are shared around it completely.

Conclusion

As well as freeing up the license cost resources back to the NHS, common integration patterns and tooling are being produced, joining up some of the other open source NHS initiatives in the process, mostly badged under the NHS England Code4Health Interoperability Community6 and underpinned by TechUK’s interoperability charter7 (enabling the ‘Newcastle Declaration’).

An excellent example of this collaboration is the HSCIC’s Care Integration and Orchestration (CIAO)8 project of work which seeks to build the basic prototype of a set of open source components in the same technology in use at King’s to facilitate electronic distribution of discharge summaries from secondary care to GPs. Open Source Integration could be the Answer1 for releasing the NHS pressure valve.

References

Training Normal Hearing People in Challenging Conditions with No Sense Syllable Stimuli

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Abstract

This study intends to investigate how to develop a new training program to help hearing impaired people improve their communicating abilities in challenging environments. It mainly focus on training normal hearing people to identify no sense syllable stimuli --vowel consonants vowel (VCV) against fixed babble noise with hard conditions to explore human’s auditory plasticity and develop viable clinical auditory perceptual training tools for hearing impaired people.

Introduction

Perceptual learning studies are not new in hearing research. However, in the literature, researchers have attempted to train hearing aid (HA) or cochlear implant (CI) users to better understand speech material in a quiet environment. Typically, auditory perceptual learning studies present speech with no background noise or other competing environmental factors. It is suggested that improving the ability of the brain to learn how to make full use of prosthetic devices is as important as developments in the technology.1 Rehabilitation and training programs have the potential therefore to optimise the performance of HA and CI users, and help them get more benefit from their prosthetic device. Training participants to listen to degraded speech will make the speech material more comprehensible, as evidenced by improved performance in speech intelligibility tasks.2

Based on our previous auditory perceptual learning study, there is a learning effect from training people with signal to noise ratio (SNR) -24dB to identify VCV tasks against fixed babble noise (same sections of babble noise on each trial) to VCV tasks against random babble noise (different sections of babble noise on each trial). The study also suggests that the harder consonants group /m,n,b,p/ obtained more learning effect with fixed babble noise than the the easier consonants group /d,f,g,k/.3 However, the previous study did not answer whether there will be a generalization effect from training with no sense syllable stimuli against fixed babble noise to against random babble noise. As it indicated that the harder tasks improved more than the easier ones, it may be worth to explore listeners’ performance with harder SNR babble noise background conditions. Therefore, the novel element of this study is that it will focus on training subjects to ignore the fixed masking with lower signal to noise ratio (SNR-30dB). It intends to investigate if both learning and generalization effects could be observed from training normal hearing listeners to identify no-sense syllable sounds VCV tasks against fixed babble noise to VCV stimuli against random background environments.

Methods

Twenty normal-hearing English native speakers (aged between 18 to 40) participated in this experiment. All of the participants had no prior experience participating in psychoacoustic experiments, and their pure-tone thresholds were within normal hearing threshold (less than 20 dB HL) [4]. The participants were all volunteers recruited from the student and staff population of the University of Warwick. The information leaflet was given before they attended this study to let the potential participates have enough time to consider. They were randomly assigned to the fixed babble noise training group or the control group. Both groups were required to do a pre and post-test with vowel consonant vowel (VCV) tasks (including one vowel /a/ and eight consonants /b, d, f, g, k, l, m, n, p/ with male and female voices) in random babble noise. The fixed group was trained with constant babble noise for three days between the pre-and-post test, while the control group was not trained. The SNR used for this study was -30dB. Calibration was carried out before the main test took place. The IEC 711 acoustic coupler and a precision microphone used to calibrate the output of VCV test. Then the maximum sound pressure levels from PC was controlled to make sure the output from the software (MATLAB) was within exposure action value (65 dB SPL).

Results

As seen from Fig.1, for the two VCV consonants groups, the identification performance was better in the poster-test than in the pre-test (ANOVA time: F1,18=32.11; p<0.001) but the listeners’ improvement was not substantially larger from the trained test group to the control group (T-test: t (18) =1.51, p>0.05). Regarding the training test group (see figure2), significant difference also showed between the pre and post average score across all the eight consonants (T-test: t (9) = -4.64, p<0.05). Compared the learning difference from the individual consonant for both the trained and control group (see table 1), there is significant difference for the eight consonant but no interaction difference for the eight consonant x group (ANOVA: sounds, F7,18=4.13; p<0.001; group x sound interaction, F7,18=0.71, p>0.05).

Table 1. Learned proportion of correct responses for individual consonants as a function of babble noise for both the test and control groups (average across the male and female speakers)

<table>
<thead>
<tr>
<th></th>
<th>b</th>
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</thead>
<tbody>
<tr>
<td>Test</td>
<td>0.625</td>
<td>22.5</td>
<td>6.875</td>
<td>11.25</td>
<td>9.375</td>
<td>8.75</td>
<td>2.5</td>
<td>8.125</td>
</tr>
<tr>
<td>Control</td>
<td>4.375</td>
<td>15</td>
<td>-0.625</td>
<td>9.375</td>
<td>0.625</td>
<td>3.125</td>
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<td>5.625</td>
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</tbody>
</table>
Figure 1. Proportion of correct responses as a function of babble noise training (all the average across all the eight consonants/d,f,g,k,m,n,b,p/), plotted separately for each of fixed (n=10) and control group with SNR -30 dB(n=10). Error bars reflect ± one standard error of the mean.

Figure 2. Proportion of correct responses as a function of fixed babble noise training (average across the male and female speakers), plotted separately for each of the eight consonants.

Conclusion
Participants’ performance significantly improved between pre and post VCV random babble noise tests for both of the two groups. However, the improvement for the fixed group was not significantly different to the control one. So there was no transfer learning occurred from the fixed babble training to random babble noise environments. Further study could be explore if the learning effect from training with random babble noise will be better or worse than training with fixed babble noise or whether the same or opposite pattern of learning will be obtained from word stimuli.

References
Posters Presentations
Investigating new business models to support remote care of chronic illnesses

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Abstract
This study investigates the application of new business models that could support a remote care (telehealth) service for chronic illnesses, using diabetes as a case study. We will determine the main barriers of patients’ engagement with telehealth services and identify how such a service could reduce GP burden. Importantly, we further investigate appropriate business models that could be used to financially support the roll out of such a service, allowing private enterprises to both contribute and benefit from this healthcare sector.

Background
The NHS needs to become leaner without compromising on the quality of healthcare provided. This can be achieved via use of new business models and technological advancements to fit the digital age we are in. An entrepreneurial approach needs to be taken in order to make an opportunity out of this adverse situation. Approximately 6% of the UK adult population has been diagnosed with diabetes. Type 2 Diabetes accounts for 90% of all cases of diabetes and hence requires substantial health service resources in terms of screening, medication, monitoring and health intervention.

In particular, monitoring and regular intervention puts a particular burden on GP services and suggests scope for a more efficient delivery of remote care services to be offered. For the first time this year (2015) diabetes medicines now account for one tenth of all prescribing in primary care, as the Net Ingredient Cost (NIC) for managing diabetes was £868.6 million, this is in comparison to 9.5% in 2013/2014 and 6.6% in 2005/2006, indicating the increased use of NHS resources by patients with diabetes.

An opportunity also exists to reduce the number of people requiring inpatient services, via more efficient screening and in particular through use of preventive medicine. Most type 2 is due to obesity thus intervention can be achieved in the form of behaviour change (leading an active lifestyle and healthy eating) which could be carried out by using apps as well as telehealth support.

In financial terms this ‘inpatient’ expenditure equates to Type 1 diabetes costing £1.007 billion, with Type 2 diabetes at £8.038 billion, while the total costs are £1.802 for type 1 and £11.718 billion for type 2 respectively; making the ‘inpatient’ segment the largest segment in NHS Diabetes spending at 65.8% of the total costs. This equates to an average cost per patient (in the ‘inpatient’ segment) of approximately £1.807 for type 1 and £2.552 for type 2 diabetes.

Research Question
This study aims to assess the viability of implementing telehealth services aimed at those accessing primary care; with diabetes being used as a case study. The study will investigate four things. Firstly, it aims to investigate views of remote GP access by potential users. This will be achieved using focus groups, with participants interviewed to input into the design of a suitable business model for these services. The interviews will be conducted in order to find out: how often users access GP services related to their problem, if accessing their GP’s services is a problem (affected by waiting times and participants’ taking time off work) and if they would engage with a remote care service.

Secondly, participants will also be questioned with regard to their prescription consumption and their use of equipment in order to manage their disease. Thirdly, GP’s will be asked for their input on bettering primary care. Fourthly, different commercial approaches will be discussed and assessed in terms of acceptance of private enterprise funding/advertising and use of data.

Materials and Methods
The views of remote GP access will be derived from a focus group, with the comments to be recorded. Key words will be highlighted from the audio transcripts, followed by pattern matching and coding. Once data saturation point is reached whereby people stop saying new things, the data collection stops. Formal qualitative analysis methods will then be used to identify the important issues and points raised within the group. This will be carried out for both patients and GPs.

Ethics Statement
The project will be reviewed by University of Warwick’s Biomedical and Scientific Research Ethics Committee. All participants will provide informed consent before participating in the study.

Conclusion
A key hypothesis is that use of an effective business model with innovative use of remote care of chronic illness in the management of diabetes will have barriers to being adopted. However, once this adoption rate threshold is surpassed the services may spread at a faster rate. Another key notion is that individual centric healthcare will allow users to have more input in their long term medical treatment, leading to positive results for both healthcare givers as well as healthcare receivers while allowing businesses that invest early in digital healthcare to reap the economic rewards.
References


Integrating Digital Technology into a Chronic Pain Pathway Leeds Community Health
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Abstract
To integrate innovative digital technology into a care pathway to promote a biopsychosocial approach to pain management by both clinicians and patients. Success will be shown in reduced referrals to secondary care, reduced GP consultations and reduced opioid prescription. Better outcome, self-care and new tried and tested approaches been proven digitally.

Introduction
Chronic pain is a Long Term Condition. It is estimated that 14 million people live with chronic pain in England alone1. 41% of people attending pain clinics reported their pain prevented them from working and 13% reduced their hours2. Four out of 12 of the most disabling conditions from the Global Burden of Disease study into years lost to disability are persistent pain conditions (low back / neck pain, migraine, arthritis and other MSK conditions)3. Pain is one of the most common causes of why people visit their GP who often lack the time and training to be able to assist patients to begin the self-management process. ADI & SBRI/NHS England funding develop the Pain Toolkit and Pain Management Plan Apps. Interoperability between the app and the patient, linking with N2 network via our partnership with inHealthcare. Self-Assessment can be uploaded in to the EPR in Systm1 & EMIS.

Methods
ADI, commissioners, GPs and lead clinicians from Leeds were tasked to review the pathway to improve the patient journey with an aim of reducing Rx, secondary care referrals/GP appointments. GPs would initiate the patient onto the app. This was to promote a self-management process amongst the GPs and their patients and give the community pain services more information to assist the triage process.

GPs felt there was not enough time to be able to instigate the self-management process so a change was implemented. Telephone assessment service was set to the scene and release the token to complete independently or attend for assisted screening prior to their second assessment. 50% of people are choosing to complete their assessments prior to their initial appointment. Patients fill the assessments in periodically through their treatment allowing reviews to take place over the phone, reducing the need for patients to attend clinics but still being able to track their progress.

Results
40% of GPs are generating tokens prior to referral, indicating an increase of awareness in the self-management process. 50% of patients referred into the community pain services are choosing to complete the information prior to their first appointment, thus reducing appointments with the health care trainers by 50% which increases their capacity for 1-1 sessions for pilates, tai chi, relaxation and supporting groups. On average 300 tokens to enable patients to access the app free of charge connecting to their own NHS number and patient file are being generated a month. 66% reduction in secondary care referrals. Indicating an increase in those being managed in primary care and reducing costs from the CCG. Using average data of 1 assessment and 4 follow up appointments per patient at a cost of £120 per appointment this indicates a £720,000 saving on yearly appointments not including the costs due to reductions in spinal injections and other interventions. It will also reduce the waiting list for secondary care for both new patients and follow ups which in some areas is well in excess of 18weeks.

Conclusion
We have had to react quickly to the feedback of the clinicians, primarily the GPs who have been less keen to take a lead in the initiating the self-management process, this then changed the way in which the service providers were required to work. Clear communication and regular meetings between all stakeholders was key to the change The Leeds project was a large and ambitious project and with such projects come teething problems which after a few months these have settled and the staff and patients are much happier with the processes. After 6 months of the new pathway being introduced the early patients are beginning to be discharged, as a result of this the full impact of the pathway change and digital integration is not currently available but the early stats which we do have are positive.

References
Experience Led Commissioning for Outcomes Based Contracting

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Abstract

East Staffordshire Clinical Commissioning Group (CCG) in partnership with Midlands and Lancashire Commissioning Support Unit (CSU) have utilised an innovative method of involvement to facilitate engagement throughout their Improving Lives Programme. Conversations with patients, public, carers and other key stakeholders started at the project inception over 2 years ago, and have been integral to both the projects development and the design of the outcome measures.

Introduction

East Staffordshire CCG knew that they wanted to commission services differently for people with long term conditions and for frail older people. The project is known as Improving Lives, and the overarching aim is to help patients with long term health issues live more independent and healthier lives. This was a new and innovative piece of work that would ultimately award a contract to a prime provider for a seven year period. The CCG knew that this needed a different way of engaging with patients, the public, carers and other stakeholders.

Methods

Midlands and Lancashire CSU used the Experience Led Commissioning (ELC) process to create an engagement solution. ELC focuses on Person-Centred Commissioning by bringing patients, families, carers, clinicians and those working in the health service together as equals. It transforms traditional relationships by shifting the balance of power so that those who use services and their families gain more influence, and join forces with commissioners to create and deliver the right mix of services to support health and well-being - both in terms of improved clinical outcomes and in the broader sense, improved well-being.

Unlike previous methods of commissioning, commissioning for outcomes is not about defining implementation plans at provider level, because we know that providers find it demotivating to be told in detail by commissioners what they need to do to improve outcomes. Specifying minute details can often stifle a provider’s creativity and remove any inclinations to innovate. Outcomes based commissioning places a duty on providers to deliver the outcomes that matter to people and their families.

The Midlands and Lancashire CSU worked in partnership with East Staffordshire CCG and ELC to design a solution. The ELC approach is flexible, and was adapted to suit the needs of this project. Whereas the usual methodology would be a series of events, for this project a mixture of events and one to one outreach work were undertaken. ELC asks different questions – after all, if you keep asking the same questions you get the same answers! These questions shift the focus, and enable the process to become outcome focused.

Results

63 days of interview work with patients and staff along with 14 days of analysis work defined the outcomes for the programme. Of the 17 outcomes 10 focus on empowerment and quality of life, 1 on health equalities, 4 on improving clinical outcomes and 2 on support for families and carers. These outcomes are described in more detail in the document Improving Lives… the story so far¹, published in March 2015.

A prime contractor was appointed during 2015, to a 7 year fixed price contract worth £230m over 7 years. Engagement work has continued throughout the process. This is a complete new way of commissioning, moving away from service specifications, activity, contract and assurance reporting to co-produced outcomes based contracts that facilitate patient centred outcomes measures. The success of this project has prompted interest from a number of other CCGs across the country. Further information about the Improving Lives project can be found on the East Staffordshire CCG website².

Conclusion

The next step in the process is to develop the patient centred outcome measures in partnership with the CCG, prime contractor, patients and carers. The focus becomes measuring what matters, not just what is easily measurable. This will then lead into the final phase which will be on-going monitoring. The ELC approach is a fantastic way to bring together multiple stakeholders to share their views and shape projects. This process is flexible and can be adapted to suit the project as it develops. It’s focus on the positives, and potential for the future brings different views, and new and exciting ideas to the fore.

References

Stepping with a Virtual Partner: Exploring the Use of Virtual Reality Avatars for Gait Retraining

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Abstract

This study investigates the use of avatars for retraining gait. Here, we completed a feasibility test by asking participants to step in time with the virtual partner viewed through a virtual reality headset. We observed that a perturbation (slowing down or speeding up one step cycle) applied to the avatar was reflected in participants’ own step timing. Therefore, we suggest that virtual partners can potentially be used for gait retraining following neurological disease such as Stroke, or following major lower-limb surgery, such as hip and knee replacement.

Introduction

Stepping in time to rhythmic auditory cues can be effective for retraining gait following a stroke1 or the onset of Parkinson’s Disease2. Rhythmic visual cues can similarly influence coordination of movement, but are only effective when the cues have spatial as well as temporal dynamics3 (e.g. a moving dot rather than a flashing dot).

A key goal of retraining gait is to improve adaptability so individuals can quickly correct movements in response to a sudden perturbation or obstacle4. Random phase perturbations can be inserted into otherwise regular auditory or visual rhythmic cues to force an adaptive response in the form of timing correction5. It is unknown whether complex visual cues such as an avatar can similarly influence step correction. However, imitation is an important human social characteristic6 which may influence an individual to accurately reflect their own movement coordination with that of an avatar.

Here we investigate if the corrective responses of healthy participants who are instructed to step in time with an avatar are influenced by perturbations to the avatar’s gait. If participants are able to accurately follow the avatar’s movements, then this could lead to more sensitive and targeted gait retraining methods.

Methods

Stimuli: A single volunteer (Male, age 37 years, height 1.8m) was recorded stepping on the spot using a 12-camera Vicon motion capture system. To set the tempo for each condition, the participant stepped in time with an auditory metronome with a beat interval of 450ms (Fast) and 800ms (Slow). Captured marker trajectories were mapped onto an avatar using Unity 3D software (see Figure, A). One of the avatar step cycles was accelerated or decelerated by 15% to create a perturbation (Figure, B).

Experiment: Four participants completed the experiment; Participants wore an Oculus Rift virtual reality headset to view the avatar. They further wore reflective markers to capture their movements using a Vicon motion capture system. Participants were instructed to step on the spot in time with the avatar, unaware of the perturbation that took place on one of the step cycles (Figure, C). Participants completed 4 trials for each of the four conditions (Tempo [Slow, Fast] x Perturbation [+15%, -15%]).

Analysis: Left and right heel step times were extracted from the movement trajectories. Inter-step intervals (ISI) were then calculated as the time between heel onsets. A repeated measures ANOVA was used to statistically test for a change in participants’ ISI following the perturbation.

Results

Participants’ mean step interval accurately matched the Avatar’s very closely for both Fast and Slow conditions. Moreover, we observed a matching response in participants’ step intervals to the perturbation step. Step intervals corresponding to one step after the perturbation were significantly shorter for the speeded perturbation ($F_{1,2} = 21.73, p=.043$) and longer for the slowed perturbation ($F_{1,3} = 38.06, p=.009$; Figure, D).
Discussion
We have shown that an avatar’s gait pattern in a virtual environment can be used to influence a person’s own gait. In particular, when a perturbation is made to the avatar’s step timing, the individual makes similar adjustments immediately after, when instructed to step in time with the avatar.

Conclusion
This proof of concept study opens up the possibility of using virtual partners to retrain gait in individuals following neurological disease or musculoskeletal injury. Having a representative guide to the exercises is likely to improve adherence and subsequently reduce long term reliance on physiotherapy services.

References
“Autographer plus Flo”: a Memory Support Intervention for People with Mild Cognitive Impairment (MCI) and People with Mild to Moderate Dementia

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Abstract

An innovative project for people with MCI/dementia employed a wearable camera, Autographer, alongside Florence text messaging service to assist people to self-manage memory problems. Patients received one memory strategy text message per day and were asked to wear Autographer and review Autographer-generated images at least 3 times per week. Measures: WEMWBS, ACE-111; semi-structured patient interviews; focus group. Preliminary results suggest that Autographer-plus-Flo is most effective for memory self-management when it is integrated into patients’ care plans.

Introduction

In the UK population of people diagnosed with either dementia or with mild cognitive impairment (a transitional stage between normal ageing and dementia referred to as MCI) there is a high prevalence of long-term comorbid conditions (LTCs) and related complaints. For example, it is estimated that between 6% and 39% of this group has diabetes, and between 3% and 34% has experienced a stroke.

A clinician-led pilot project in 2013 was conducted in a mental health NHS trust. It involved sending protocolled Florence (Flo) simple telehealth text messages to eight patients with MCI who had additional LTCs including depression, diabetes, heart disease, and anxiety. Texts functioned as prompts to patients to self-manage their health conditions by taking actions to reduce their vascular risks. Findings from a pragmatic evaluation of the pilot confirmed that delivering self-management support via Flo text messages was an acceptable method to patients and often resulted in patients taking positive action to manage their conditions. Furthermore, although it was known by patients that the texts were delivered via a computer, patients described Flo in human terms – “like a friend”, “someone looking out for you”.

The current Autographer plus Flo project targets people with MCI and people with mild to moderate dementia. Patients are invited to use a wearable, automatic camera called Autographer (previously known as ‘Sensecam’) and to review their Autographer-generated images at least three times per week in order to support autobiographical memory. Alongside the wearable Autographer patients receive Flo text messages, the content of which is memory strategies to help with functional memory.

Methods

The ten people with dementia and nine people with MCI who were recruited to the project were given their own Autographer and signed up to receive free Flo text messages over a 6-month period. All nineteen patients continued to receive care as usual in addition to their participation in the project. The project is currently being evaluated using semi-structured interviews and two measures routinely used in clinical practice - Warwick-Edinburgh Mental Well-being Scale (WEMWBS) and the Addenbrooke’s Cognitive Examination-111 to assess patients at the start and end points of participation. At between two and five months into each patient’s participation they are invited to take part in a semi-structured interview to provide feedback on their experiences.

Results and Discussion

Preliminary emergent results are based on feedback given during nine interviews, one focus/discussion group, and pre and post WEMWBS and ACE-111 scores. All participants were keen to try the Autographer plus Flo approach, viewing it as something that may help them manage their memory problems. Everyone was able to grasp the basic competences involved in using Autographer, and some participants developed sophisticated ways of using Autographer: for example, one person took Autographer with him during fishing trips and used it to take photographs of fish he caught. Most participants who were interviewed gave encouraging accounts of how reviewing Autographer images prompted memory recall, and the majority were able to narrate accounts of salient memories during interview. Flo text messages, designed to provide memory strategies, were valued by participants - a number of whom saved their texts to refer back to. It was found that participants had adapted to memory problems via a range of self-styled informal strategies to self-manage memory problems and associated physical and mental health conditions. Autographer plus Flo was considered an enhancement to patients’ own strategies, rather than a replacement for them. A review of available ACE-111 scores from patients shows either only minor reduction or an improvement in scores. The pre and post WEMWBS scores available so far show that a majority of scores have improved. In terms of patients’ ability to sustain their use of Autographer plus Flo it appears that this is more likely to be achieved when the approach is integrated into patient’s plan of care than when it is separate.

References

Demonstrating the Value of Co-design: a Mobile Application for Persons with Dementia and Their Carers

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Abstract

Many mobile health applications or ‘apps’ exist but few are co-designed with patients and carers in mind. A mHealth initiative called ‘My House of Memories’ was co-created by people with dementia and their carers in the United Kingdom. An in-depth focus group and interviews were conducted with the team involved in co-producing the app. Data was analysed thematically using the framework approach. Results indicate that the co-design process had numerous benefits for individuals involved and the personalised app was better suited to the needs of people suffering with dementia and their informal carer network.

Introduction

Dementia is becoming an important public health priority as the World Health Organisation predicts that the current number of people, 35.6 million in 2012, who suffer the debilitating, chronic condition is set to triple by 20501. The Department of Health in the United Kingdom (U.K.) have set out a national dementia strategy which aims to create a range of services that meet the needs of people with dementia and their carers2. A digital initiative called ‘My House of Memories’ was launched in Liverpool to help achieve this national objective. This involved people with dementia and their carers in the design and development of a mobile application that allows them to share memories together3. The aim of this study is to explore the impact of the co-design process on the participants to demonstrate its value in creating personalised technology for people living with dementia.

Methods

An exploratory case study design was used. A focus group with ten people involved in co-producing the ‘My House of Memories’ app as held in March 2015. This was followed by interviews with two of the four dementia patient-carer dyads from the focus group. A software engineer and a project manager, from the National Museums Liverpool, involved in the co-design workshops and developing the app were also interviewed. Data was thematically analysed using the framework approach4.

Results

People with dementia and their carers who participated in the co-creation workshops benefited directly from the process as they took a sense of pride from creating a personalised piece of mobile technology that would help people with dementia, “So you know that’s the greatest sense of pride that we get that we’ve developed something that is going to help other people, it wasn’t just a fun thing for us to do.” (Person with dementia, focus group, March 2015). They also learned how to use tablet devices and made personal connections and friends through the co-production process. The participants also gained immense value from using the mobile app in their daily life as it facilitated communication between persons with dementia, their carers and wider family, “I think for me I’m confident that in the future you know when I’m inevitably going to lose more of my memory I’m sure that I’ll use it even more with the device with my family and that that will help me, not halt the disease or anything but help alleviate the deterioration a bit because it’s there and it’s my memories” (Person with dementia, interview, September 2015). It also helped stimulate memory, allowed personal histories to be shared and acted as a form of entertainment which provided a level of normalcy to people living with dementia, “it’s not all about memory here, dementia, it’s actually seeing that and now they have put music in because music to people with dementia is the greatest thing ever, because it just brings us alive, it makes us come alive, we feel great” (Person with dementia, focus group, March 2015).

Discussion

Many digital applications are generic and co-design offers one way to create tailored technological solutions to meet the needs of people living with long-term debilitating conditions such as dementia. The app is currently being used by over 5,000 people mainly in the U.K. and is being further developed to include more objects and functionality. In the future it could serve as a form of reminiscence therapy and help improve mood, cognition and functional ability as well as reduce caregiver strain.

Conclusion

More research into co-creating digital products and services with patients and carers should be done to uncover the complexities involved and help create robust methodologies that are theoretically grounded as well as better designed technical solutions.

References


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Engaging Users with a Personal Child Health Record: the eRedBook Case Study

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Abstract
The eRedBook, which is a personal child health record, was recently piloted in the United Kingdom. An exploratory case study examined the factors which facilitated its roll out among Health Visitors who recruited parents to use it. Interviews and focus groups were conducted with those implementing the eRedBook and individuals taking part in the initial pilot. Data was analysed thematically using the framework approach. Numerous socio-technical factors facilitated the engagement and enrollment process such as the use of clinical champions, having the right mobile technology, digital literacy training and a flexible recruitment strategy. These will be essential to implementing the eRedBook nationwide.

Introduction
A new digital application called the ‘eRedBook’, which is an electronic version of a child health record, was recently piloted in two National Health Service trusts in the United Kingdom1. Public health nurses, known as Health Visitors (HVs), helped to roll out this personal health record (PHR) with parents. They also used it to document childhood development as they would with the paper based version. PHRs are being explored as a way to give citizens control over their own health data and encourage more self-management2 but how to effectively engage and enroll users is not well understood. This study seeks to explore the factors which facilitated the participation of HVs and parents in the eRedBook.

Methods
An exploratory case study approach was used. Baseline (n=6), midpoint interviews (n=3) and endpoint (n=2) interviews were done, between October 2012 and August 2015, with a range stakeholders implementing the eRedBook. Two mixed focus groups were also conducted in April 2015 with twelve parents and nine HVs involved in the pilot of the PHR. Data was thematically analysed using the framework approach3.

Results
Several themes which facilitated the roll out of the eRedBook among HVs and parents emerged. Firstly, clinical champions were identified who became key to promoting the digital application and signing parents up to use it, “We’ve identified Health Visitor champions who are going to be the sort of first users to pilot the eRedBook so we’ve been starting to get them trained up and ready” (health service manager, interview, June 2014). The fact that the software was easy to use and mirrored the paper based version where possible enabled HVs to adopt the digital tool quickly and demonstrate it to parents, “they are really pleased that the eRedBook looks like the paper Red Book so they are not having to learn something completely new, it looks very familiar and looks very similar to what they are used to using so that’s a real bonus” (health service manager, interview, June 2014). HVs were also supported with the right technology and training which gave them a new way to interact with their client base, “for me to have an iPad was just brilliant!!! Because I learnt a lot and it dragged me into the next century” (focus group, health visitor, April 2015). Finally, a flexible approach to recruitment which included HVs along with more direct marketing methods reached more parents and enabled them to participate in the pilot, “I think the Health Visitor did actually tell me about it, when she came to do the first visit at home, so yes, so I probably got a leaflet as well, but I’m sure she would have said, oh, there’s this new online eRedBook trial going on, if you want to take part, she mentioned it to me” (focus group, mum, April 2015).

Discussion
Engaging lay and health professional users and encouraging them to sign up to a personal health record requires the right social and technical infrastructure to be successful. To facilitate the deployment of the eRedBook nationwide more resources will need to be invested in ensuring HVs have the right technology and training and the PHR is marketed directly to parents.

Conclusion
More research on how to engage a range of clinical and non-clinical users to participate in PHRs is needed if they are to become an established and widely used type of digital health record.

References
Single Phase Locking Value Classification Algorithm for Motor Imagery Based BCI

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Abstract

Electroencephalogram (EEG) based Brain Computer Interfaces (BCI) are becoming a new communication channel for people with a motor disability. Specially, motor imagery (MI) applications where the system is able to translate the motor intentions of the participant into a control signal. In this study we propose the use of single-trial phase synchrony (S-PLV) measure for classifying mental tasks on an emotional-based BCI system. For this end, we compare the accuracy of the system across a variety of pair-channels, frequency bands, classifiers algorithms and validation methodologies.

Introduction

Phase Locking Value (PLV) is a time-frequency domain measure of synchronization obtained averaging across trials, what is not suitable for online classification purposes. For this reason the measure used in this study is S-PLV as the average is across a selected time window. In this paper we have selected five different classifier approaches and compare their accuracy to discriminate between MI tasks.

Methods

A. Feature Selection

For each pair of the EEG channels, S-PLV value was calculated for 7 different narrow frequency bands ranging from 6Hz to 20Hz with 2Hz width. Furthermore a broad band between 6 and 20Hz was also included. We have used the pattern recognition toolbox for Matlab named Prtools¹ to calculate a maximum subset of 8 features. Linear discriminant analysis was used to estimate the error of the system. In addition, an 8 fold crossvalidation scheme was added to the algorithm to avoid over-fitting.

B. Classification

In order to find the right classifier for this specific application we have selected 5 different classifiers. Two linear classifiers: fisher’s least square linear discriminant (named fisher along this paper) and linear Bayes discriminant (ldc). Furthermore, we selected a support vector machine classifier (svc), a back-propagation trained feed-forward neural net classifier (bpxnc) and a K-nearest neighbour classifier (knnc), with K=3. In order to estimate the performance of the different classifier algorithms we selected 3 methodologies to compare results: single 10 fold crossvalidation, 5 times 2 fold crossvalidation and single 8 fold density preserving split (dsp).

Results

A. Feature selection subset

As expected, the classification error decreased inversely to the number of features, a subset of 6 features was selected as a good trade-off between the algorithm performance and relatively low computational cost. The criterion followed to decide the frequency band to feed the classifiers was the most repeated band across participants within the selected subset of features. Following this ideate, the frequency range highlighted was the narrow band ranging from 14Hz to 16Hz. In the same way, the most commonly selected channels pairs by the SFFS algorithm were Cz-C2, Cp6-P6, Poz-CP6, Fcz-P5, Cpz-P5 and P1-C4.

B. Classifiers performance

In order to select the classifier algorithm that suits better to our purposes we performed a comparison between 5 diverse classification approaches. All of them were validated using 8 fold dsp cross validation technique. Results were confirmed applying Anova analysis between classifiers, obtaining a p-value of 0.01, an indicator that classifier factor affects accuracy. Nevertheless, inspecting the accuracy results, for 5 participants out of 9 the higher accuracy is obtained with the ldc option. If we also consider its simplicity and wide spread use it will be the best candidate for MI emotional based BCI classification.

Conclusion

This paper presents a study on the synchronization measures as a classification methodology for emotional-based BCIs. A diversity of frequency bands, channels pairs, validation techniques and classification algorithms were compared with the aim to find the most suitable procedure to achieve the highest accuracy for our system. The selection feature algorithm indicated that a narrow band, in this case 2Hz width, presented more discriminant features than a broadband. The accuracy of the classifiers presented in this work demonstrated that the use of single phase locking values can be used for motor imagery purposes associated to emotional BCI systems. The accuracy performance could be improved further by combining synchronization measures with different features. Furthermore, the inclusion of more participants on the study will give us more consistent results.

References

Using Secure Instant Messaging to Enhance Patient Centred Care

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Abstract

Mobasheri et al. explored the ownership rates of smartphones, tablet devices, related apps and uses of these technologies among doctors and nurses. It highlighted that 89.6% of doctors and 67.1% of nurses have used proprietary and un-secure instant messaging apps to share patient identifiable data. We will demonstrate how the Novastone digital secure messaging platform can support the delivery of health and social care.

Introduction

A recent paper by Mobasheri et al. explored the ownership rates of smartphones, tablet devices, related apps and uses of these technologies among doctors and nurses. It reported that 92.6% of doctors and 53.2% of nurses found their smartphone to be either ‘very useful’ or ‘useful’ in helping them perform their clinical duties. It also highlighted that 89.6% of doctors and 67.1% of nurses have used proprietary instant messaging apps to send patient identifiable data to each other.

The poster will propose that this current practice is compromising patient identifiable data but by using secure instant messaging clinicians can safely use technology to communicate between themselves and engage with patients. It will explore the benefits of secure messaging on care. The poster will outline the article findings in detail and highlight the positive benefits of using a secure instant messaging app enabling clinicians to connect, communicate, collaborate and share data together safely. Secure instant messaging can also be used to engage and connect with patients, who in turn become empowered to manage their own conditions.

Discussion

The article described an up-to-date UK-based, multi-centre, cross-sectional survey study on the ownership rates and uses of these technologies among doctors and nurses, specifically focusing on the clinical environment. The study was performed at a large London-based NHS Trust consisting of five individual hospital sites. All doctors (n=2107) and nurses (n=4069) employed by the NHS Trust were invited to participate.

In the poster, we will propose that clinicians, social care and community nursing teams working in Primary Care, and Community settings can use secure measuring to deliver integrated care irrespective of the EPR or record system that is used by their organisation. Technology often brings about disruptive change to the way in which clinicians and staff work. The poster will propose that the change this technology brings is minimal and the article cited demonstrates that doctors and nurses are already looking to use messaging in their care delivery and need a secure application to use.

Novastone digital secure messaging platform has been developed for highly regulated industries such as finance, health and care. It enables highly safe and secure, audit-able orchestrated and asymmetrical conversations. Clinicians have the option of using web-based, desk top or mobile interface to engage and share data safety with patients or customers on their own mobile phone. This technology enables them to connect, communicate, collaborate and share data using secure instant messaging with their peers, multi-disciplinary, multi-agency teams and engage with their patients in real time and on the move. Details of the app’s technology functionality will be demonstrated.

Conclusions

The article by Mobasheri et al. outlines a clear use case for secure messaging in healthcare. The Novastone product is new to the market place and is currently being piloted. Further detailed work needs to be undertaken on the impact of secure messaging on the delivery of health and social care.

References

Dynamic Scheduling for Mobile Health Care Professionals

Stuart WATKINS
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Abstract
There are many classes of scheduling problem and extensive mathematical research has been carried out into classifying them and developing algorithms to address them. Real world scheduling problems such as community care are very hard to resolve with these algorithms. Practical solutions need to use a successive approximation technique to find “quite good” solutions. TotalMobile will provide an overview of their scheduling engine which uses genetic algorithms that are based on principles of Darwinian evolution.

Introduction
The dynamic scheduling challenge is to enable a fully integrated and flexible workforce management strategy for mobile health care professionals (HCPs):

- individually and collectively
- in multiple care settings
- with different roles & skills requirements

Then allocate effectively, efficiently, economically to any given patient (including loved ones)

- with different complexities of needs
- who may need many services from different HCPs
- across Acute, Community, Primary, Mental Health & Social Care

Methods
I will talk about the science behind the dynamic scheduling of referrals. Explain our “Mendel” optimisation engine that uses genetic algorithms too rapidly evolve the best solutions to scheduling problems and deliver different priority outcomes such as shortest route, smallest workforce, meet service-level agreement (SLA), etc. How it works in concert with mobile working and the rich feedback that mobile working can provide to a scheduler to deliver ‘Continuity of care” for the outset.

Results
Results for the case study that will be referenced are as follows

Improving lives of staff & patients
- 30% more time with patients and two additional visits per nurse per day
- 100% increase in lunch and handover times
- Lone worker monitoring
- 60% reduction in data entry time

Enhancing patient care:
- Reduction in missed appointments through resource re-allocation
- 42% improvement in referral handling
- Continuity of Care
- 50% reduction in DNAs

Discussion
- What is the best schedule?
- What does an end to end referral use case look like with dynamic scheduling behind it?
- Why does the HCP in the field care?
- Why does triage team/referral hub care?
- Why does the executive board care?

Conclusion
A genetic approach is powerful at absorbing community health care scheduling problems dynamically.

It will be used as an ‘Intelligent Assistant’ by referral hubs to enable SMART Workforce Management of mobile HCPs in multiple care settings for
✓ better
✓ faster
✓ and earlier health care
✓ across health and social care
Panel Sessions
Harnessing Health IT to Address Challenges in Healthcare

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Abstract

Health IT has been a powerful catalyst to modernising and improving the performance as well as the quality and safety of healthcare services. Nevertheless, health IT can also constitute a threat to patient safety. Relying on health IT requires harnessing its potential, achieving benefits whilst remaining confident that potential side-effects are manageable and worth taking. The paper introduces the challenges of health IT, providing examples found in literature, and by documenting the experience of the authors.

Introduction

Introduction of technology in healthcare is seen as a driver for substantial improvement in safety and quality of the offered healthcare services, whilst also making it more cost effective. Health IT has enabled improvement of the safety of healthcare services in two main ways; offering new capabilities that contribute to the overall patient outcomes and actively reducing the error rates of healthcare services. However, introduction of IT has also introduced threats to the safe provision of healthcare services, due to the IT systems themselves. IT, is mainly deployed as the infrastructure of many of the healthcare services, and because of this it has the potentially to affect all its users, and expose them to risk. These threats and the risk to the patient associated with them, need to be analysed, understood, and reduced to acceptable levels.

Health IT as a safety enabler

An IT system can fall into the category of health IT, if it contributes in some way to patient health outcomes, either participating in the treatment of an acute or chronic condition, as well as contributing to monitoring and prevention of conditions, also helping with the overall well-being of a person. Given the above criteria, we can characterise as health IT, not only systems deployed in healthcare organisations (for example, electronic prescription systems, picture archiving and communications, and electronic health records), but also patient centred services (such as mobile applications, online portals as well as cloud services).

New capabilities have assisted healthcare professional in making their day to day tasks more safe, by offering better information as well as automating tasks that are distracting or prone to mistake. Health IT is used to assist with interpreting results, for example an electrical signal into more meaningful clinical information. Development and interconnectivity of electronic health records (EHRs) provides more complete, accurate and accessible patient information. EHRs include a more thorough patient history offering a better insight in diagnosis as well as a more complete view of the treatment of chronic conditions. Furthermore, interconnectivity of records aims to provide patients seamless access to healthcare regardless of location or professional attending the needs of the patient, with a notable example that of cross border healthcare with the European Union, support for clinical decision making, and post-treatment patient monitoring as well as rehabilitation. Additionally, health IT has offered functions for active error reduction (i.e. detection and recovery from error) in healthcare services. For example, implementation of safeguards in electronic prescription services such as warnings for unexpected values in a prescription for a certain condition, and implementation of automated alerts highlighting abnormal values of results or real time patient data, which require acknowledgement that have been noticed.

Studies report a decline in adverse events due to introduction of health IT. Hydari et al¹ report 30% decline in medication errors due to use of advanced Electronic Medical Records (EMRs). A study on the perception of Electronic Health Records (EHRs) by physicians concludes that over 60% of the participating physicians reported that, in addition to overall quality (and its indirect implication in safety patient due to more efficient treatment), EHRs helped with direct improvement of patient safety (critical values, and medication error alerts)².

Health IT as a threat to safety

IT systems are integral to healthcare providers as they enable functionality (or improved attributes of existing functionality such a throughput) necessary for healthcare services. However, IT systems can be the culprit of failures that may eventually result in patient harm.

One of the challenges with IT, is that the way in it contributes to hazards can be conspicuous and convoluted (having also been described as silent errors³). Contrary to other more easily perceived hazards such as, errors during a surgical procedure, a medication error, or failure of a medical device such as a pacemaker, IT failures are more indirect and distant from harm. Software and data are immaterial and do not interact with patients in as easily perceived ways as physical elements of the system. In health IT adverse events are usually related to information provision (either as a result of information being absent or its potential to be misleading). For example, IT will not give a patient the wrong medication or dosage but may provide the wrong information on which a clinician may rely; for example, the wrong medication or wrong dosage. Furthermore, IT can be a catalyst to human predisposition to failures given certain conditions. For example, consider a clinician, under time and load pressure who might select the wrong administration route for a drug (e.g. oral instead of intravenous) due to a suboptimal graphical interface⁴.

¹ The authors are members of the patient safety panel session of the WIN conference. This abstract has also been used to scope the subjects that will be covered by the panel members.
Health IT is becoming entangled with health services, affecting the quality of care of all patients. For example, all patients in a clinical organisation may be managed by a patient administration system or will be given medication ordered using an electronic prescribing system. Hence a fault in the IT has the potential to be replicated numerous times, exposing many patients to the risk. Healthcare organisations should actively seek information that will maintain their confidence in the operation of the IT or reveal faults that will need to be corrected. Healthcare organisations should sustain a process looking for potential events with catastrophic impact, to which they (organisations) may have been oblivious for a number of reasons, such as complacency, or disregard of evidence that could warn about such situations. Establishing confidence in the safe operation of health IT should be an ongoing process with stakeholders constantly evaluating new information and analysing new functionality offered.

The need to for safety assurance of health IT

Over the years, and motivated by a number of accidents, there has been significant interest on behalf of contractors, customers and independent authorities, in being able to capture and communicate assurance about the safe operation of a system. In all domains, assurance of safe operation is achieved by understanding the contribution of the system to hazards, and deriving and implementing requirements that will remove or reduce the hazards to acceptable levels. A number of processes are needed to produce the information needed to achieve this. Applicable regulation does impose the use of different standards, which provide a trade-off between putting the onus on manufacturers or operators arguing safety and offering a prescribed set of steps the rigor of which is assumed to offer higher degrees of safety assurance.

Assuring the operation of a healthcare service can be a mandatory requirement, imposed by either the legal or regulatory framework. However, this is not the only motivation for assurance; healthcare service operator can demonstrate a duty of care for the offered services, including confidence that the risk to patient from health IT (among other sources), is acceptable. Furthermore, other stakeholders may have a vested interest in understanding and being convinced about the risk levels of healthcare operations, such as patient organisations. Risks will exist whether or not we choose to acknowledge them; not doing so may result in heterogeneous healthcare between providers. Different organisations may exhibit variable risk levels due to a different configuration and mixture of technologies, organisation culture and technological maturity, integration of processes and procedures with technology as well as training.

A clinical service is a collection of systems, processes, procedures, devices and medicine, as well as personnel. Collaboration of all these is not fortuitous but analysed and designed in a way to provide quality and efficient healthcare. One of the qualities of healthcare is the safety of patients due to the risks that occur from failures of this collection of systems. JCAHO standard LD.5.2 requires that “leaders ensure that an on-going pro-active program for identifying risks to patient safety and reducing medical/health care errors is defined and implemented”. Understanding how the systems may fail, and how these failures may propagate through interfaces and collaboration, is essential to design the necessary measures that will eventually justify placing our assurance on their operation. There are two main issues with the operation of such large scale and complex IT systems: confidence in the operation of each system individually, and confidence in the operation of assembly of systems collaborating. A number of Issues such as operational assumptions, the lack of analysis, change management, training, and procedures may result in risks even when the constituent systems operate as intended.

Characteristics of health IT systems such as their complexity, size, reliability, affect both the way the system may affect safety but also the lengths at which we should go to assure ourselves about their safe operation. For example, consider a complex system that spans across many parts of an organisation, interacts with people, and processes and stores complex and large amounts of information. Such a system will require more rigorous analysis employing multiple analysis methods such as IT testing, human factors analysis, as well as analysis on its impact on the workflow of the healthcare services that it supports. Similarly, an IT system that is novel will need more analysis than a system that has been used for a significant amount of time and with the technologies of which people are familiar. These system attributes can often allow us to anticipate the extent of the safety assurance process, in order to result in confidence in its safe operation.

Understanding the operation of a system within its operational context inevitably requires input to the developer that will share the tacit knowledge of the users and the operator (e.g. clinicians describing how exactly the system will contribute to the provided healthcare). Rigorous safety assurance process requires rigorous collaboration between the operator, manufacturer and the regulator. In order for these stakeholders to communicate effectively there is a need for commonality of practice such as terminology, processes, artefacts and the means to share them, as well as convergence of practice stipulated in standards.

Conclusions

Use of health IT has provided new capabilities that have resulted in a net effect of patient safety improvement, in addition to benefits such as cost efficiency and performance. However, IT has also been observed to result in failures that will threat the safety of a patient. Although this is something to be expected, stakeholders need to establish assurance about safe operation of these systems, something that entails identification of the threats and reduction of their associated risk. The rigour of the process that will offer assurance about the safety of a health IT system, can depend on certain attributes of the system such as complexity and defence mechanisms incorporated such as detection. Participation to the analysis of healthcare professionals with experience on the actual service that a system will support, is crucial in order to elicit tacit knowledge that will be used to make system design decisions.

References

Technology Enabled Care Services (TECS) as an Exemplar of Person Centred Care
West Midlands Academic Science Health Network, Stoke-on-Trent CCG, UK

Abstract
A WMASHN project to show how simple technology can support the delivery of person centred care – supporting common long term conditions, including COPD, asthma and diabetes and addressing adverse lifestyle habits. In line with the WMAHSN TECS Person Centred Care (PCC) manifesto outcomes, the project aims to raise awareness of self-management technology tools, whilst striving for health care use efficiencies through their uptake. The team offers to work alongside staff to raise their confidence to adopt new TECS to benefit their practice.

Introduction
The NHS is 20 years behind the private sector in its use of technology with very slow uptake of telehealth and technology enabled delivery of care across the NHS and social care settings. Many new TECS schemes can take up to three years to embed, recruit and train the workforce and achieve impact from delivery of the scheme. The PCC exemplar team, has been driving the rollout of Florence Simple Telehealth and has now expanded to promote other technologies. Many national strategies promote the potential person centred care benefits to be gained from integrating technology into widescale delivery of care – in particular text messaging, mobile phone apps, skype, telecare and telehealth. Advantages of using this media include cost savings, less medication wastage, fewer unplanned admissions, enhanced team and services productivity, fewer home visits and face to face consultations, enhanced clinical outcomes, with healthier ageing citizens and greater convenience for patients, carers and practitioners. Barriers to deployment by NHS and social care organisations, need to be minimised to enhance high quality, financially sustainable care in the future. Project outcomes in the PCC Manifesto are:

Outcome 1: Increased awareness and experience of clinicians in the use of TECS;
Outcome 2: Improved clinical outcomes for patients and service users through the use of TECS;
Outcome 3: Improved patient and service user experience in the support they receive through TECS;
Outcome 4: Less avoidable health care usage when supported by TECS;
Outcome 5: Upskilled health and care professionals in the use of TECS in delivery of services to drive improved care and health care use efficiencies.

Methods
A function of the PCC team was to create a support network across regions with five ‘how to do it’ sub-regional TECS events for leads and practitioners from NHS and social care. The aim of the events was to promote a range of TECS already available free of charge. The PCC team supplied each CCG (22) with intelligence packs demonstrating where population-based gaps in care exist and what specific TECS might help. The team also directly approached Patient Participation Groups to enlist participants. Separate presentations on Skype, Social media, Manage your Health App and Florence Simple Telehealth were given. Follow-up support from the team was made available, to enable each service to make the best use of technology in supporting their service users.

Evaluation: Outcome measurements will be jointly conducted by the WMAHSN exemplar programme team and Keele University utilising online surveys, semi-structured interviews, codes on the managing your health app, measuring number of downloads, percentage of people still using the app feature after 4 weeks, clinical feature most used. Healthcare usage data from practices and other teams to demonstrate Skype, Flo, Facebook use.

Results
Over 200 delegates representing 91 organisations (CCGs, primary care, providers Trusts, local authorities, universities/academia, third/voluntary sector, industry attended the five events. Examples of different organisations are given below:
Robust attendance across the five events was encouraging. Delegates left the events with action plans around online or one to one ongoing support from the WMAHSN funded project team. Delegates were encouraged to try TECS in their workplace and to take up offers from the PCC team. They were particularly struck by the usefulness and development of FLO and the app, with widespread interest in how to include social media as a communication tool with patients and service users.

Outstanding questions from the events, which continue to be addressed by the PCC team:

- Is there any evidence of cost-savings with utilising Flo and other TECS?
- Introducing new technology is an ongoing process. What are the next steps and how may we engage?
- Where can we access more information on data protection?
Are there opportunities for the PCC team to engage with the charitable sector?

Following the five sub-regional events, the team will continue to work with commissioners to help them understand the benefits of TECS in addressing population-wide health gaps (via CCG Intelligence Packs) – with support from Public Health England and the CSU and hold local events for the general public to understand apparent gaps.

The PCC team will directly support action and delivery plans and dissemination of TECS to a minimum of 50 teams in NHS/social care across region. The team will further develop online resources for remote learning, such as a social media ‘how to do it’ toolkit, skype, example protocols and case studies, to contribute to the growing evidence base for greater use of technology in health and social care.

Conclusion

Feedback and registered declarations of interest from the five events, demonstrates an appetite for inclusion of TECS in modern working practice. Indeed, there is cross-organisational broad agreement that TECS adoption is a necessity to meet growing demands and challenges in health and social care, yet momentum at grass-roots level remains slow due to a reluctance to embrace new tools. There is a prevailing perception that introduction of new techniques creates more demands, which, rather than being time savers, will add to the work burden. It is the role of the PCC team to demonstrate that integration of new ways of working can improve efficiency and effectiveness. Uptake of the PCC team as a resource across the regions, will be closely monitored and reported on in the coming months together with how the opportunity to integrate different TECS has impacted service delivery.

References

3. Cottrell E, Cox T, O’Connell P, Chambers R. Patient and professional user experiences of simple telehealth for hypertension, medication reminders and smoking cessation BMJ Open http://bmjopen.bmj.com/cgi/content/full/bmjopen-2014-007270?ijkey=iSJSZ2IP6qocrO&keytype=ref

Panel Member Biographies

Paul Copeland

Since 2013, Paul has been extensively involved with technology enabled care services (TECS) as National Operations manager for Simple Telehealth/Florence (Flo) and Project Operations Manager for the West Midlands Academic Health Science Network’s (WMAHSN) Integrated Care Simple telehealth/Flo exemplar that supported the WMAHSN ‘push’ approach to adoption of innovations across the West Midlands. Paul is also the TECS Lead for the Midlands and Lancashire Commissioning Support Unit. These roles have involved extensive engagement at senior levels; with frontline practitioners in organisations across the whole region and Paul has facilitated collaborative working with organisations through a project team of clinical champions, facilitators and mobilisation fellows.

Chris Chambers

Chris has been a Clinical Telehealth Facilitator for Stoke-on-Trent Clinical Commissioning Group, since 2011, teaching NHS and local authority health and social care professionals to use simple technology to improve the care of patients and service users. The Simple Telehealth Florence programme for text messaging has been the main focus, and Chris was involved in the successful national rollout to CCGs across England. More recently, Chris has helped health and social care professionals in the West Midlands area to develop new clinical applications as part of the West Midlands Academic Health Science Network focus on integrated and person-centred care.

Karen Pickavance

Karen has undertaken the Clinical Telehealth Facilitator role for the West Midlands Academic Health Science Network, since June 2014. Working with a West Midlands client base, Karen has trained health and social care professionals to introduce Simple Telehealth Florence to their daily practice to improve patient and service user interventions. Since June 2015, Karen has supported health and social care professionals in the West Midlands adopt new TECS as part of the West Midlands Academic Health Science Network focus on integrated and person-centred care.
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